TECHNOLOGY DEPT.

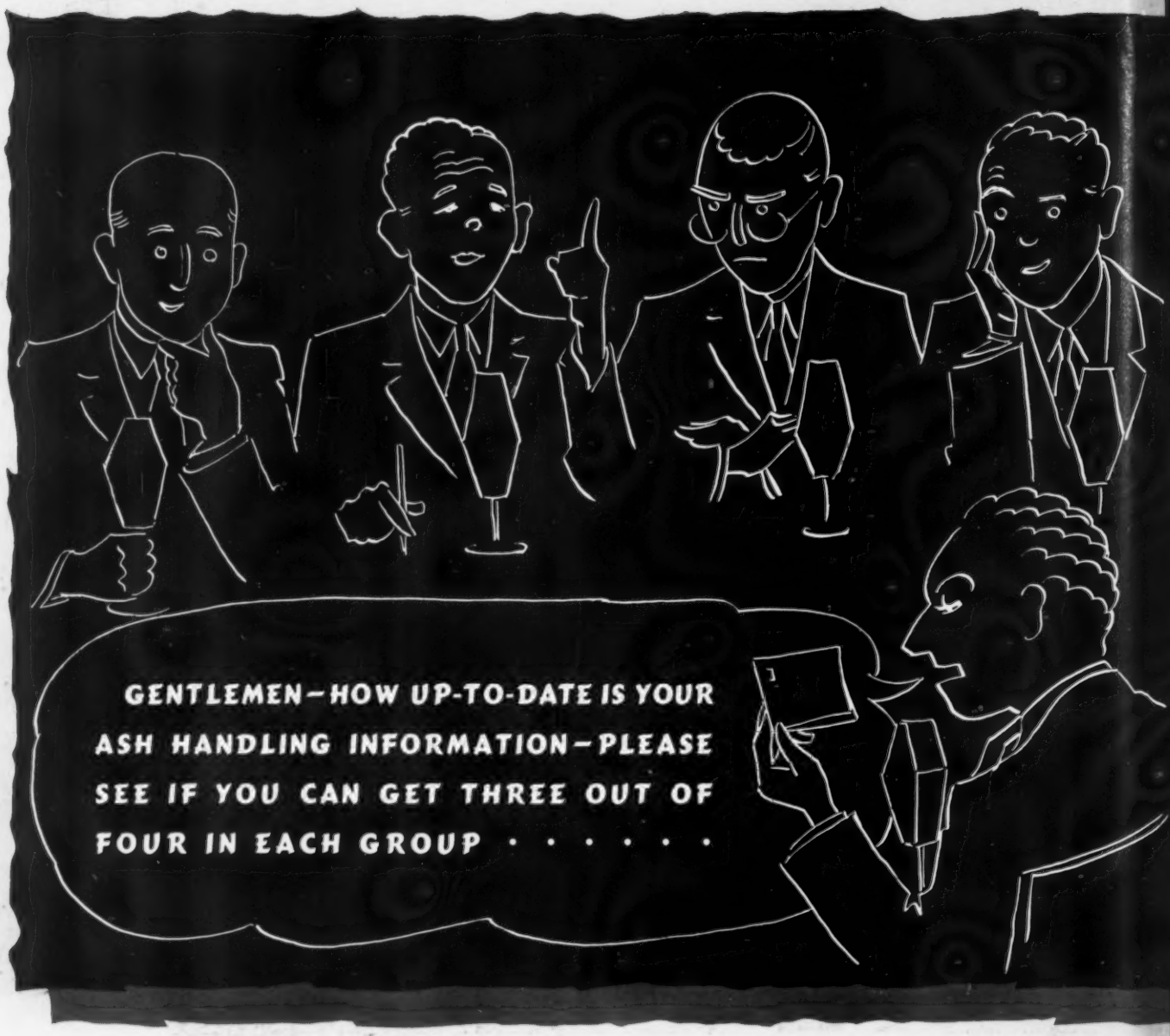
POWER

POWER GENERATION, TRANSMISSION, APPLICATION AND THE ATTENDANT SERVICES IN ALL INDUSTRIES

JUNE, 1943

In this issue

DIESEL- AND GAS-ENGINE MAINTENANCE



GROUP NO. 1

This set of questions was submitted by Mr. Hyd. Rojet of Ashton.

Q. What company pioneered every modern development in hydraulic ash removal? (*That's easy.*)
Q. When and where was the first Slag Tap Hydrojet System put into operation? (*Tougher.*)
Q. What system of ash removal is more expensive to operate than the Hydrojet? Consider labor and power only. Forget dust and cleanliness for the moment. (*Easy, too.*)
Q. How fast will the Hydrojet handle stoker ash or powdered coal ash? (*Somewhat difficult.*)

GROUP NO. 2

This set was submitted by Mr. H. Y. Drovac of Dustlessville.

Q. What is a Hydromix Valve? How does it operate? (*Should be easy to answer.*)
Q. What is a Hydrovactor and to what kind of valves is it connected by piping? (*Not too hard.*)
Q. What is the easiest way to ultimately dispose of dust collected from various points in the plant? (*Easy.*)
Q. What kind of a dust valve would you use to prevent coking in the dust pocket behind the last boiler pass? (*You should know.*)

GROUP NO. 3

These questions were sent in by Mr. H. Ydro Seal of Pumptown.

Q. What is the cheapest method for transporting ashes to point of final disposal? (*Easy.*)
Q. How much per ton, would you say, this cheapest method would cost? 50c? 25c? 1c? (*Easy.*)
Q. What pump was specially designed for handling ashes? (*Simple.*)
Q. What special design characteristics would you look for in a pump to handle ashes? (*Easy.*)

GROUP NO. 4

This group was submitted by Mr. Hy. D. Robin of Tankboro.

Q. What is the simplest way to store ashes and periodically unload them to railroad cars? (*Not hard.*)
Q. Why can ashes be pumped into a bin and discharged commercially dry into a car or truck, without housing the ash gate or any part of the tank to prevent winter-time freezing? (*Easy.*)
Q. If you pumped ashes into an overhead bin, can the water be reclaimed, and if so, how? (*Somewhat hard.*)
Q. What type of pump was specially designed to recirculate water containing some abrasive particles? (*Easy.*)

Turn to Page 162 for answers

ALLEN-SHERMAN-HOFF CO., 227 S. 15th St., PHILADELPHIA • *Offices & Representatives in Principal Cities*

POWER (with which are consolidated "Science and Industry," "The Engineer Review," "The Engineer," and "The Stationary Engineer"), June, 1943, Vol. 87, No. 6. Published monthly with an additional Directory number in December. McGraw-Hill Publishing Company, Inc. Publication office, 99-129 North Broadway, Albany, N. Y. Editorial and Executive offices, 330 West 42nd Street, New York, N. Y. Entered as second class matter August 25, 1936, at Post Office, at Albany, N. Y., under the act of March 3, 1879. Printed in U. S. A. Allow at least ten days for change of address. All communications about subscriptions should be addressed to the Director of Circulation, 330 West 42nd Street, New York, N. Y. Subscription rates—U. S. and U. S. Possessions, $3.00 for one year, $4.00 for two years. Canada, $3.50 for one year, $5.00 for two years. Great Britain and British Possessions 36 shillings per year. All other countries $6.00 for one year, $9.00 for two years, 35c per copy.

Commercial and Industrial

LINK-BELT

★ ★ AUTOMATIC COAL STOKERS ★ ★

are NOW Available for Conversion from Oil or Gas to COAL

In a full range of sizes up to 300 B.H.P. for bituminous coal

TYPICAL CONVERSION JOBS

75 lbs. per hour ⬅

In an apartment building

200 lbs. per hour ⬅

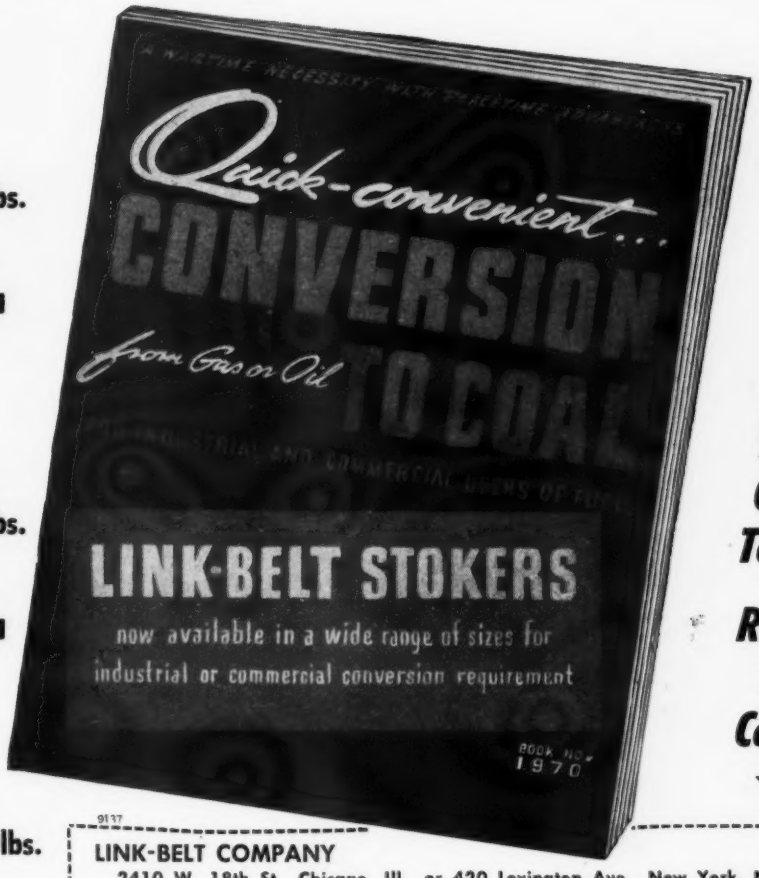
In a rug cleaning plant

650 lbs. per hour ⬅

In a warehouse

1250 lbs. per hour ⬅

In a defense plant



Get Your Copy Today! • Return This Coupon ⬇

9137

LINK-BELT COMPANY
2410 W. 18th St., Chicago, Ill., or 420 Lexington Ave., New York, N. Y.

Send copy of new Link-Belt Conversion Book No. 1970.

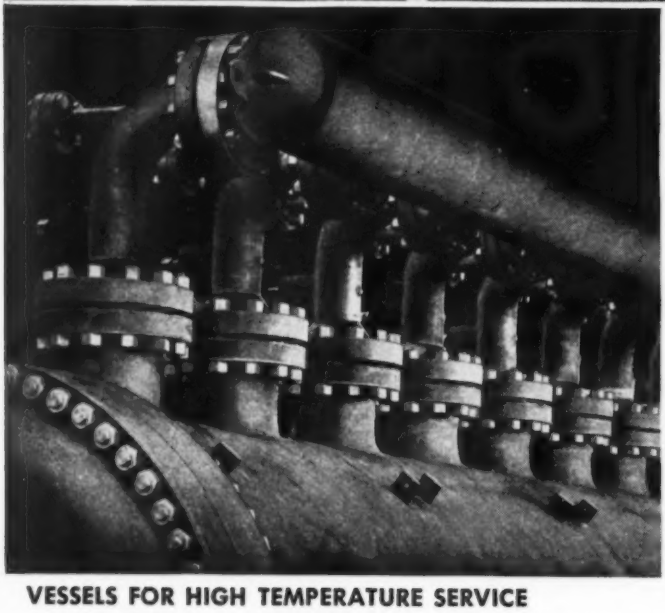
Name _____ Firm _____

Address _____

City _____ State _____

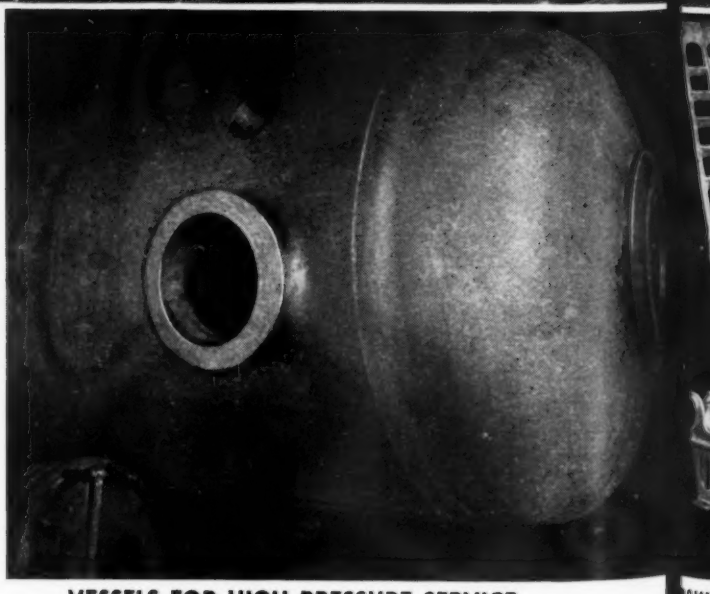
DIFFICULT FABRICATION

Pressed elbows, tapering from 30 inches to 25 inches diameter, made from 4 inch plate, connected to header. Design pressure, 1475 lb. per sq. in.



VESSELS FOR HIGH TEMPERATURE SERVICE

Vessel shown is built of Croloy 2 plate, with streamlined openings — for service at 100 lb. per sq. in. and 1050 F.



VESSELS FOR HIGH PRESSURE SERVICE

Showing pushout connection welded in 66 inch diameter shell. Design working pressure, 1475 lb. per sq. in. Pushout made of 6¼ inch plate.

B&W process equipment solves problems of temperature and pressure

B&W designing skill and manufacturing experience are developing new and practical solutions for problems encountered in installations of vessels, drums, castings, forgings and tubular products where high temperatures or high pressures must be withstood. Production of such equipment represents a major activity at B&W, where an outline of *your* problem will be welcomed.

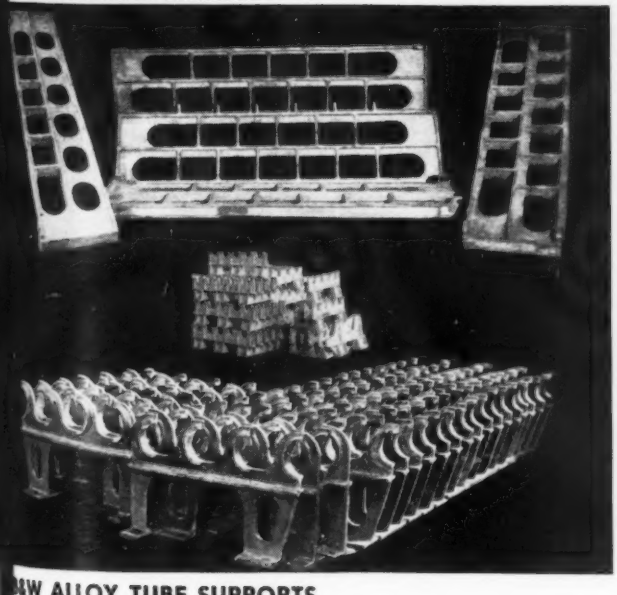
S-32-T

BABCOCK & WILCOX

VESSELS. DRUMS. CASTINGS. FORGINGS

FOR HIGH-TEMPERATURE, FOR HIGH-PRESSURE SERVICE.

THE BABCOCK & WILCOX CO., 85 LIBERTY ST., NEW YORK, N. Y.

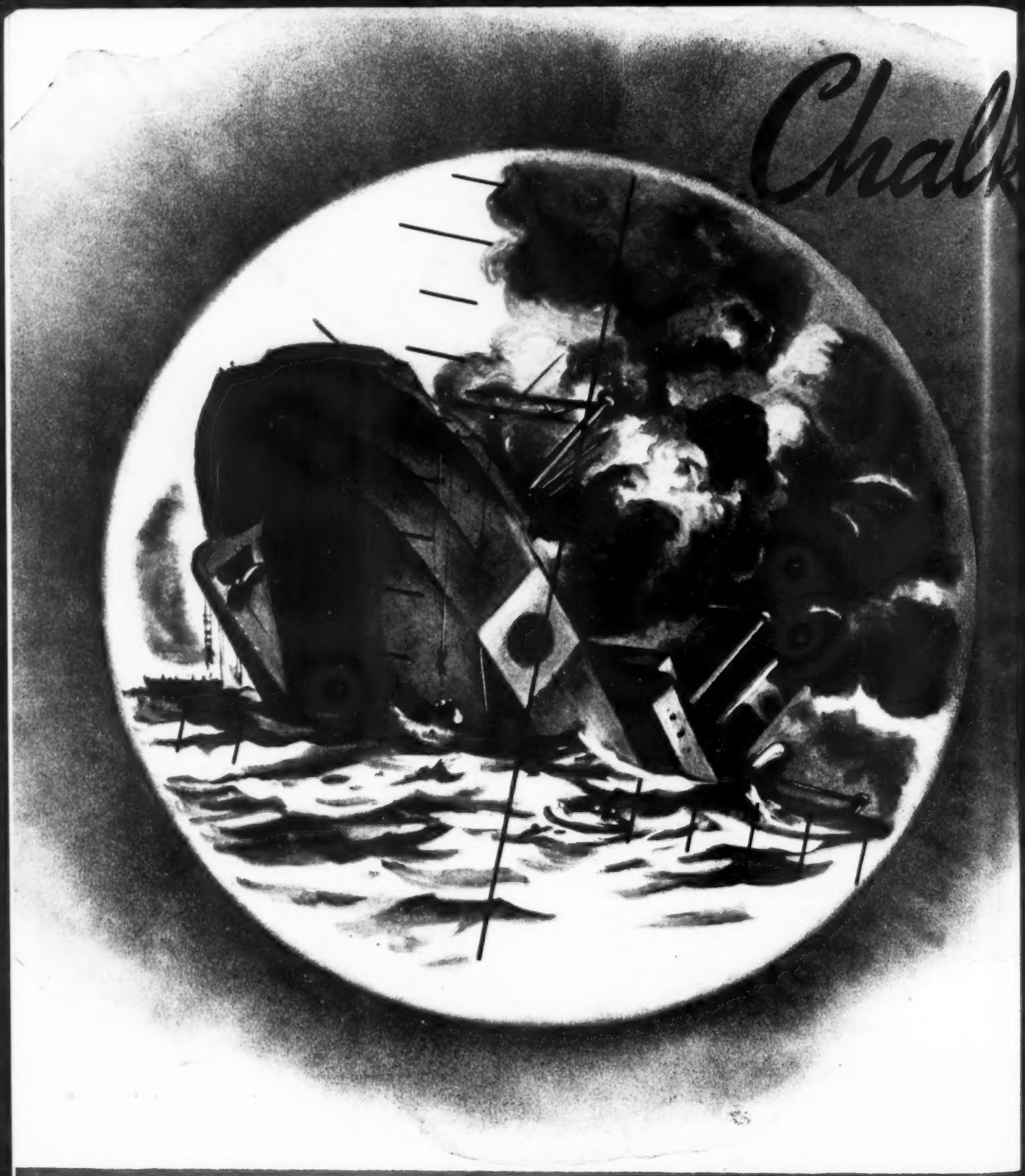


&W ALLOY TUBE SUPPORTS

More than two million pounds of B&W Alloy Tube Support Castings have been supplied for service temperatures as high as 2000 F., where high creep strength is required. Not a service failure has been reported.

B&W STREAMLINED OPENINGS

All reinforcing is forged and drawn from parent metal. Concentration of stresses is avoided.



MOTORS *and* GENERATORS

one of America's great builders

...up another home run!

WHEN good men and good equipment get together, results are pretty sure. Uncle Sam's subs are proving it.

For a good many years now, Elliott has been building electrical equipment for the Navy, with special emphasis on generators and main propulsion motors for submarines. It gratifies the men of Elliott Company to feel that these Elliott-built units are now helping Uncle Sam's subs to make good scores.

In these motors and generators, the limitations on weight and dimension are such that the most skillful engineering is required. The result is more kw. and hp. per pound than is ever achieved commercially. All steel is stressed to the maximum with respect to magnetic and electrical qualities. All other metals except conductors wherever possible are of aluminum alloy or other light material. Comparatively, it is easy to design a motor of normal dimensions for a given hp., but it needs exceptional skill and experience to meet the limitations imposed in these jobs.

That same skill and experience is building an enviable reputation not only for Elliott motors and generators, but also for the entire line of Elliott power plant and process equipment.

The Army-Navy "E" has been awarded to both the Jeannette and the Ridgway plants of Elliott Company.

STEAM TURBINES • GENERATORS • MOTORS • CONDENSERS
FEEDWATER HEATERS AND DEAERATORS • STEAM JET EJECTORS
CENTRIFUGAL BLOWERS • TURBOCHARGERS FOR DIESEL ENGINES
TUBE CLEANERS • STRAINERS • DESUPERHEATERS • FILTERS

ELLIOTT COMPANY

Electric Power Department, **RIDGWAY, PA.**

DISTRICT OFFICES IN PRINCIPAL CITIES

L-744A

...rs by **ELLIOTT**

...ns of power and process equipment

DIAMOND

Soot Blowers

have been "Drafted"

How to make the most of those you now have

AT THE present time, nearly the entire product of the Diamond plant is "drafted"—earmarked for war industry, navy or marine service.

As a result, we have had extreme difficulty in supplying many of our old customers with their needs. Even when priorities are high, it often takes a longer time than we would like to fill an order. As a result, some customers have had to get along with the soot blowers they have. We deeply regret this situation and we want to do everything possible to alleviate it.

Much can be done to keep your soot blowers in service and up to the mark in efficiency. Careful treatment will enable you to prolong their service life far beyond usual expectations; and this is easy to do.

For example:

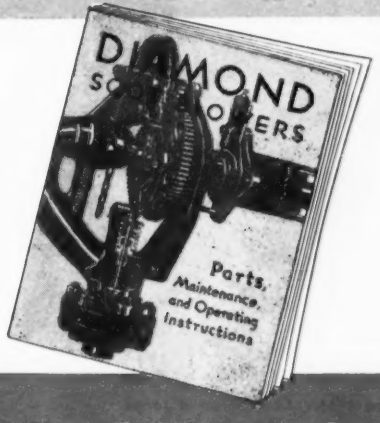
See to it that your blowers are regularly inspected and lubricated. Every time a boiler equipped with Diamond Soot Blowers is taken out of service, the equipment should be checked carefully to see that bearings are tight, that the nozzles register correctly with boiler tubes, and that blowing ranges are right. Boiler tubes and headers

near the blower elements should be examined to determine whether there are any flat spots or grooves which indicate abrasion.

Repairs or adjustments should be made before the boiler goes back into service.

These, and other measures which will be detailed in future advertisements, will help you get the service you need.

We have a booklet on servicing Diamond Soot Blowers. Send for a copy.



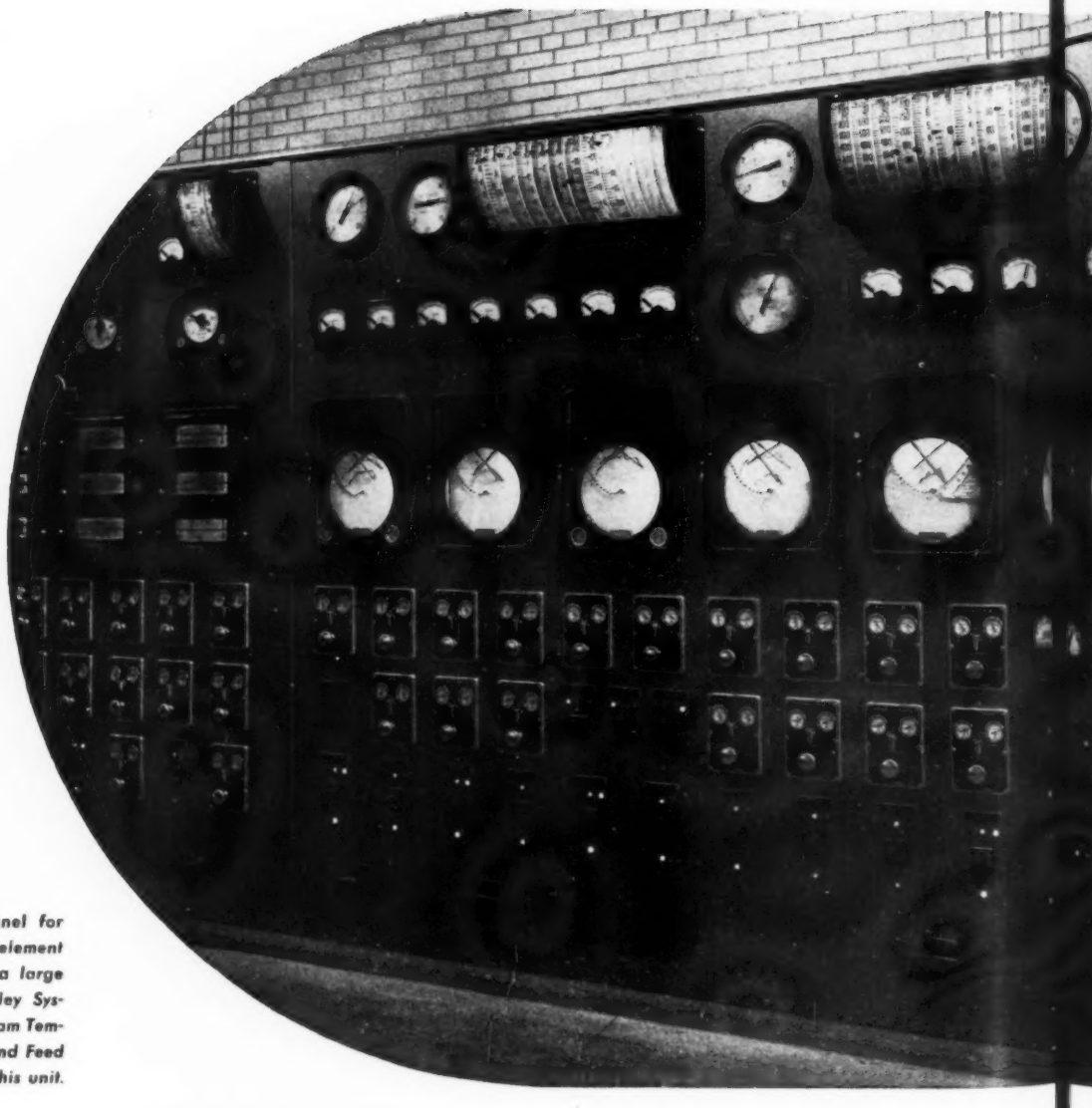
DIAMOND POWER SPECIALTY CORP.

DETROIT, MICHIGAN

DIAMOND SPECIALTY LIMITED • Windsor, Ontari

"AN OUNCE OF
IS BETTER-

Boilers, Furnaces, S
to-Replace Units C



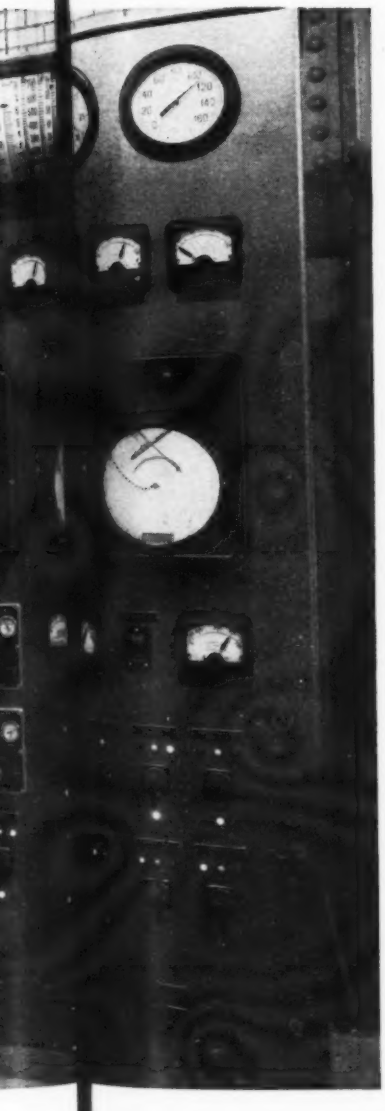
Bailey Meter Control Panel for Combustion and Three-element Feed Water Control on a large Power Boiler. Other Bailey Systems for the control of Steam Temperature, Heater Levels and Feed Water Pumps also serve this unit.

BAILEY METER CONTROL

BOILER METERS • MULTI-POINTER GAGES • FLUID METERS • RECORDERS • SUPERHE

F PREVENTION
R- - -"

es, Superheaters, Turbines, Pumps and other Hard-
its Can Be Protected by *Bailey Meter Control*



★ Before the battle of production, an outage of a power unit usually had little effect on productive capacity, replacement parts could be quickly secured, and experienced maintenance men were available. Now all this is changed and the power engineer must try harder than ever to avoid the always costly shut down for repair.

Bailey Meter Control is an effective defense against many of the causes for such shut downs, such as:

1. Destructively high furnace temperatures.
2. Dangerously low or high water levels.
3. Excessive steam temperatures.
4. Insufficient flow through boiler feed pumps and superheaters.
5. Loss of ignition in the furnace.
6. Explosive mixtures of fuel and air.
7. Unsafe operating sequences.

Even with inexperienced operators, Bailey Meter Control enables the power engineer to secure continuity of operation, together with fuel conservation and protection for both personnel and equipment.

If your plant is engaged in War Production, we suggest that you investigate fully the possibilities of preventive maintenance made possible by Bailey Meter Control.

BAILEY METER COMPANY
1036 IVANHOE ROAD • CLEVELAND, OHIO
Bailey Meter Company Limited, Montreal, Canada

BAILEY METERS

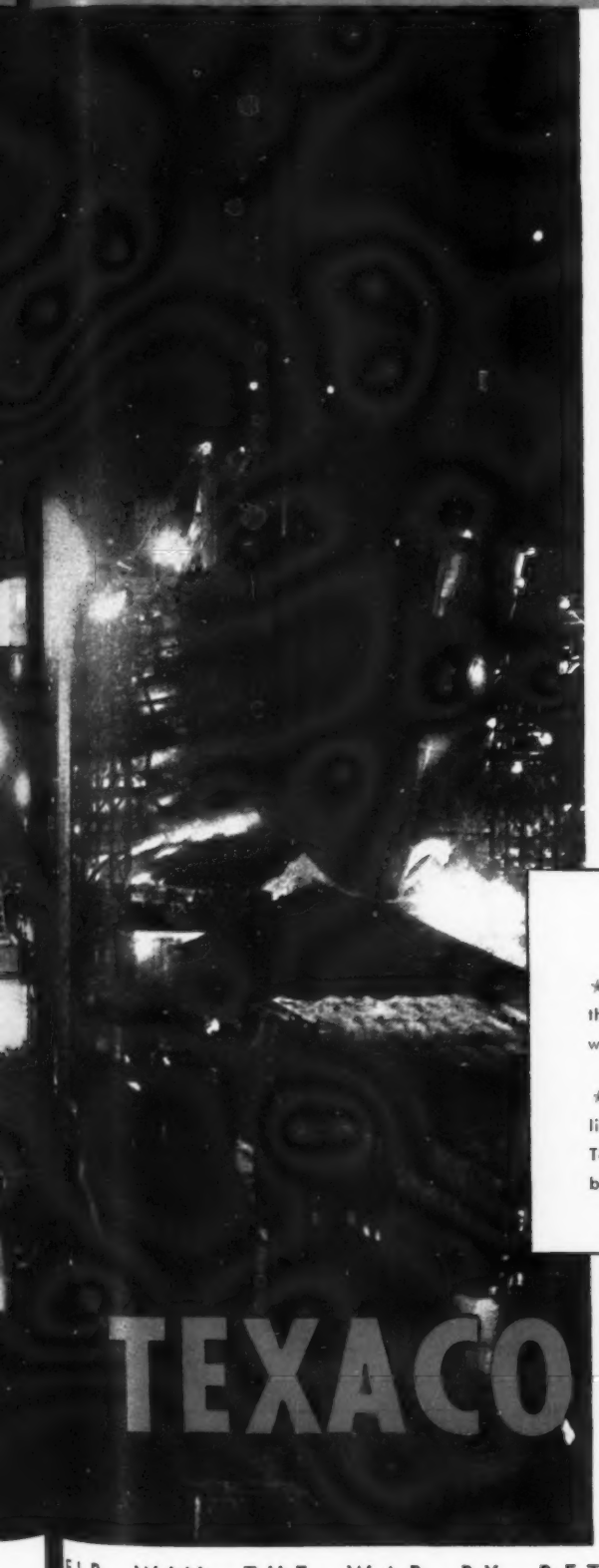
L· ·· *The Complete Boiler Control System*

UPERHE NTROL • DESUPERHEAT CONTROL • COMBUSTION CONTROL • FEED WATER CONTROL

POWER'S CONTRIBUTION TO

TUNE IN FRED ALLEN EVERY SUNDAY NIGHT—CBS

TO *Liberty!*



ENGAGED in the most colossal shipbuilding program of all time, America is delivering more than 100 cargo ships each month. To achieve this unprecedented construction rate, shipyards are working round the clock. Turning night into day in this 24-hour-a-day operation is a vital wartime contribution of electric light and power.

Producing the constantly increasing power needs for shipbuilding and other essential industries is placing heavy demands on turbo generating equipment. To assure maximum output, power plants everywhere are lubricating their steam turbines with *Texaco Regal Oils.*

Texaco Regal Oils rapidly free themselves from air and water, and highly resist oxidation and emulsification. They keep lubricating systems free from harmful gum and sludge deposits, assuring normal bearing temperatures . . . and governors instantly responsive to every load-change.

So effective have Texaco Lubricants proved that they are definitely preferred in many other important fields, a few of which are listed in the panel.

A Texaco Lubrication Engineer will gladly cooperate in the selection of the most suitable lubricants for your equipment. Just phone the nearest of more than 2300 Texaco distributing points in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York, N. Y.

THEY PREFER TEXACO

★ More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.

★ More Diesel horsepower on streamlined trains in the U. S. is lubricated with Texaco than with all other brands combined.

★ More locomotives and railroad cars in the U. S. are lubricated with Texaco than with any other brand.

★ More revenue airline miles in the U. S. are flown with Texaco than with any other brand.

★ More buses, more bus lines and more bus-miles are lubricated and fueled with Texaco than with any other brand.

TEXACO Regal Oils

TEXACO REG. T.M.

FOR ALL TURBINES

ELP WIN THE WAR BY RETURNING EMPTY DRUMS PROMPTLY

Simplify transformer installations with all-purpose Pyranol transformers

From the one fact that Pyranol* won't burn spring many benefits that would otherwise be difficult to obtain. Since you don't need expensive, fireproof vaults, you can install Pyranol transformers anywhere you wish—in the basement, on overhead beams, on the roof, or on the factory floor *at the center of the load*. Load-center distribution is highly desirable today because of the great savings in secondary copper that it makes possible. (Also, power losses are less and voltage regulation is 40 per cent better in the usual case.)

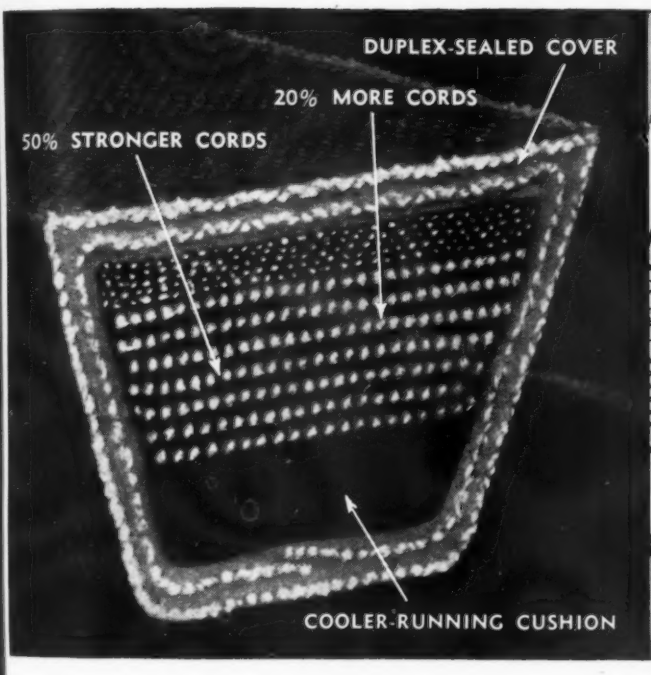
And whether the location you choose is indoors or outdoors, above ground or underground, wet or dry, clean or dusty, these *all-purpose transformers* will supply the power for your war loads with little or no maintenance.

*Pyranol is the G-E trade name for askarel, a noninflammable, nonsludging insulating liquid. Ask your G-E representative for Bulletin GES-2974—the complete story for a safer plant. General Electric, Schenectady, N. Y.

GENERAL ELECTRIC

War Slogan FOR V-BELTS— "Make 'em Last!"

(HERE ARE TWO WAYS TO DO IT . . .)



1

BUY THE BEST BELTS . . Texrope Super-7's new design-against-wear gives maintenance a head start. The 20% more cords — made 50% *stronger* by the new Flexon process — combat stretching, give Super-7's extra pulling power. Revolutionary new shock-absorbing cushion of special cool-running rubber eases pulling cords around sheaves. Tough, new Duplex-Sealed cover protects inner belt structure against grit, grime and moisture. When you *do* need new V-belts, *invest in the best* — Texrope Super-7!

2

USE THE BEST CARE . . Whatever brand of V-belts you now use, you can make them last *longer* by following the tips in Allis-Chalmers' free handbook: "Plain Facts on Wartime Care of Rubber V-Belts." How V-belt anatomy affects maintenance . . . what determines V-belt "life expectancy" . . . here is the full story, packed with practical data — fully illustrated. The new handbook contains no advertising, applies to *all* makes. Tear off the coupon below and send for *your* copy of this valuable new handbook today!

ALLIS-CHALMERS

TEXROPE* SUPER-7 V-BELTS

WE WORK FOR VICTORY — WE PLAN FOR PEACE

*Trade mark registered U. S. Patent Office. Texrope Super-7 V-Belts are the result of the cooperative research and design genius of two great companies—Allis-Chalmers and B. F. Goodrich—and are sold exclusively by Allis-Chalmers. Available in all sizes.

ALLIS-CHALMERS MFG. CO.
Milwaukee, Wisconsin

Gentlemen:

Yes, I would like to receive free of charge a copy of your "Plain Facts on Wartime Care of V-Belts".

(Name) _____

(Title) _____

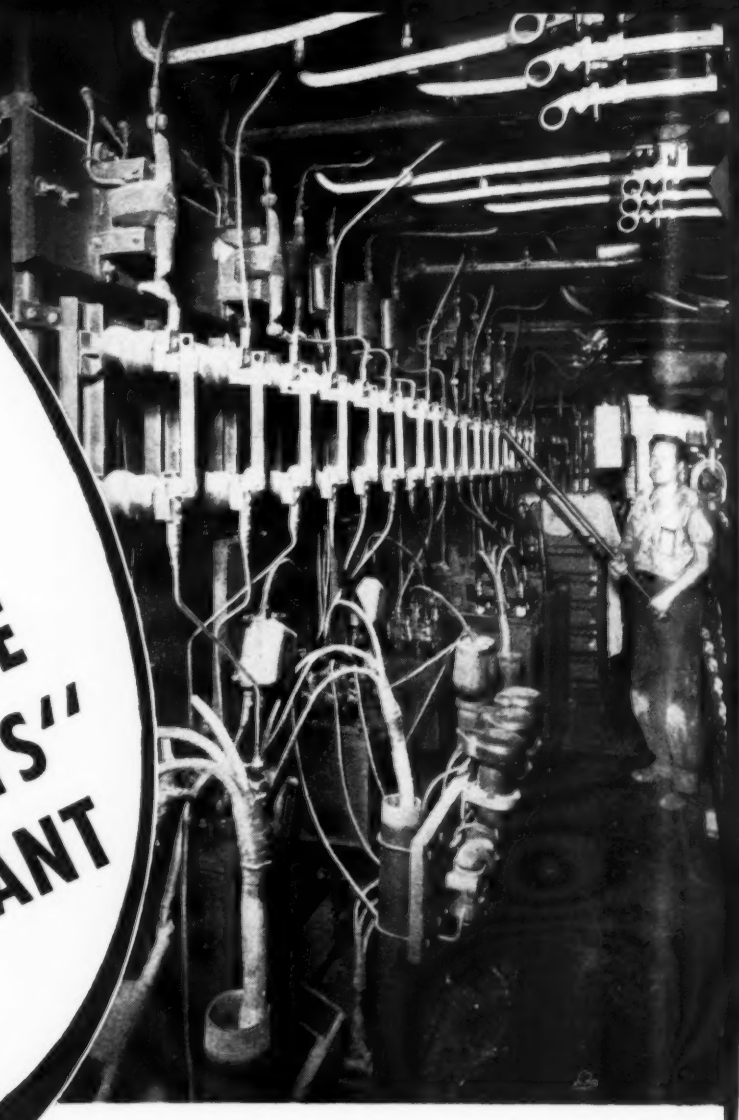
(Company) _____

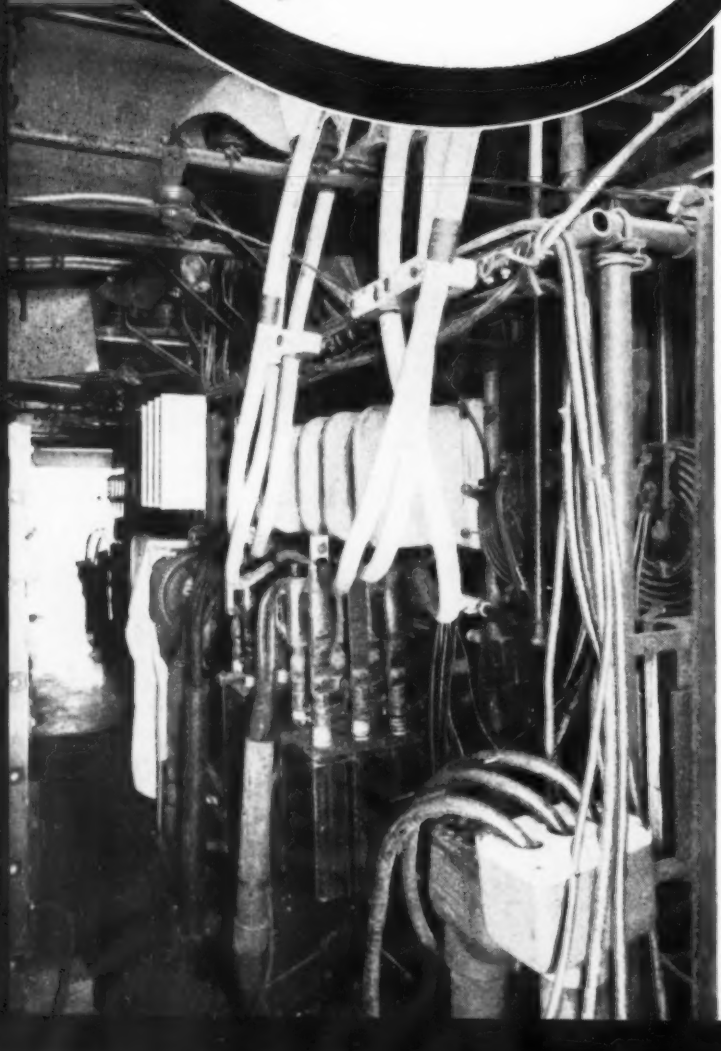
(Street Address) _____

(City and State) _____ A-1606-D

Watch Out

FOR "LIVE-WIRE ENTANGLEMENTS" IN YOUR PLANT





PROTECT PERSONNEL AND PRODUCTION WITH . . .

Safety-enclosed Switchgear

DANGEROUS "spiderweb switchgear" like this originates as strung-out, open-type switchgear, and grows more dense and more dangerous every year that additional devices are added. It often adds up to power interruptions and accidents to personnel.

That's why compact, safety-enclosed switchgear is going not only into today's new and enlarged plants but also into scores of existent plants to replace exposed, open-type assemblies. Industry knows that its job is far too big—and its man power too precious—to trust in haphazardly exposed devices.

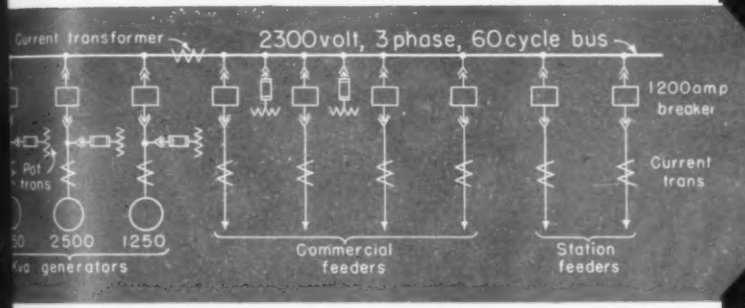
Today you can select, order, and install safety-enclosed switchgear in less time than ever before, because General Electric has *standards* to fill your needs. Standard load center unit substations, too, consisting of *metal-enclosed* switchgear and *Pyranol* transformers. Scores of war plants have kept in step with swelling power needs by installing these safe, compact, factory-assembled units instead of dangerous open-type assemblies. They give you long-term safety and dependability—save tons of vital copper.

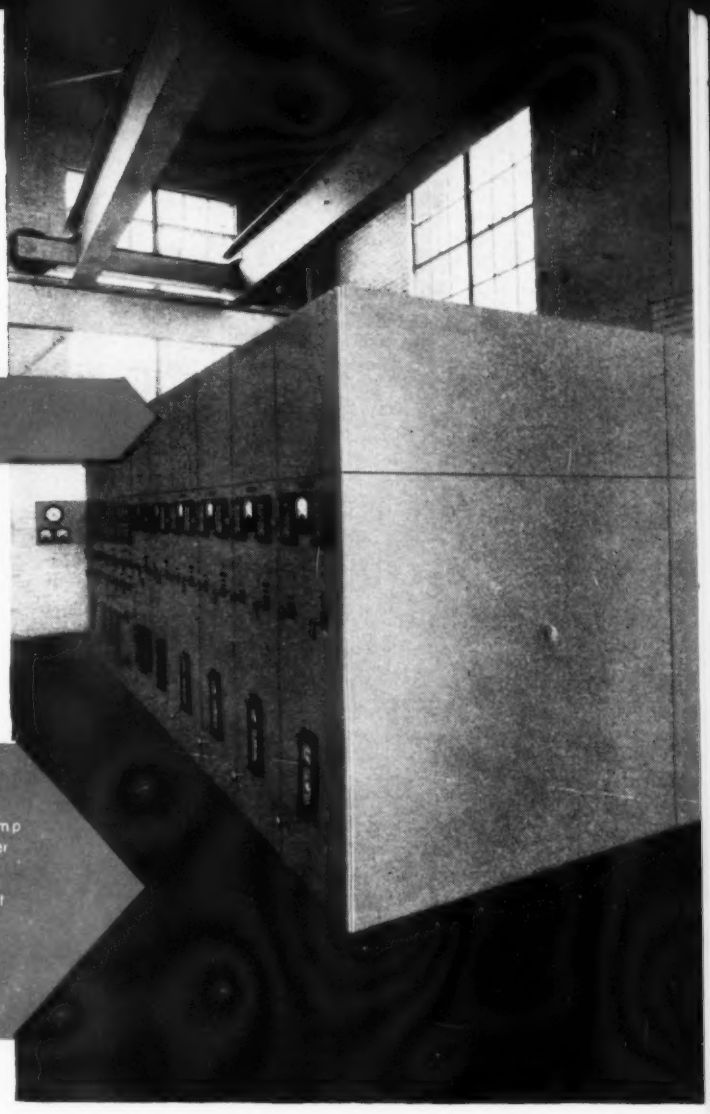
THIS DANGEROUS AISLE LINED WITH LIVE COPPER WAS WIPED OUT . . . .

. . . WHEN THIS MODERN SAFETY-ENCLOSED SWITCHGEAR® WENT IN

. . . because metal-clad includes breakers and all associated equipment—instrument transformers, buses, and connections—in one safe, compact "package."

This simple, one-line diagram enabled us to put our switchgear factory right to work on the safety-enclosed units shown at the right.

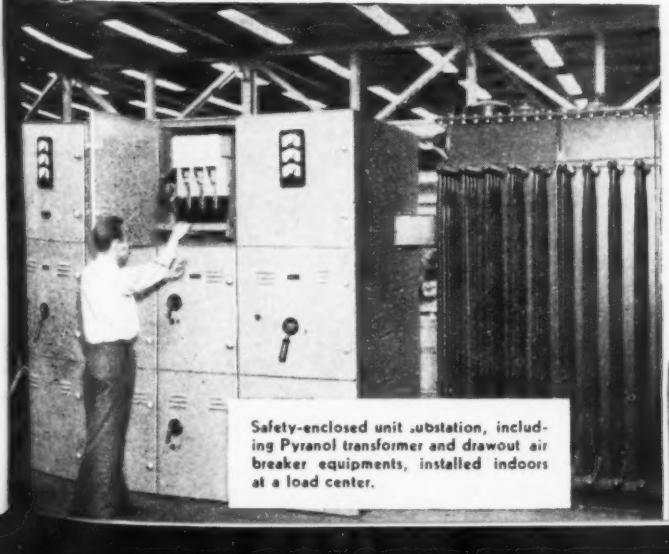




SAFETY-ENCLOSED UNITS LIKE THESE CAN BE INSTALLED . . . *QUICKLY*

With the one-line diagram of the electric system, General Electric engineers helped select *standard* switchgear that filled every requirement. It took a relatively short time to manufacture the standard units. They were shipped complete—on arrival, they had only to be set in place and connected.

The modern metal-clad switchgear with vertical-lift breakers took over the load, the old open-type apparatus was removed, and power was continued without interruption.



Safety-enclosed unit substation, including Pyranol transformer and drawout air breaker equipments, installed indoors at a load center.

. . . AND WITH TONS LESS COPPER

These metal-clad switchgear units took only 47 pounds of copper each—less than one-fourth as much as open-type assemblies for the same job. This is because compact, metal-clad construction does away with the many long, strung-out copper interconnections of open-type switchgear—replaces them with a few short ones. Also because copper disconnecting switches like those on the opposite page are entirely eliminated by modern, vertical-lift breakers that can be quickly and easily connected and disconnected from the main buses.

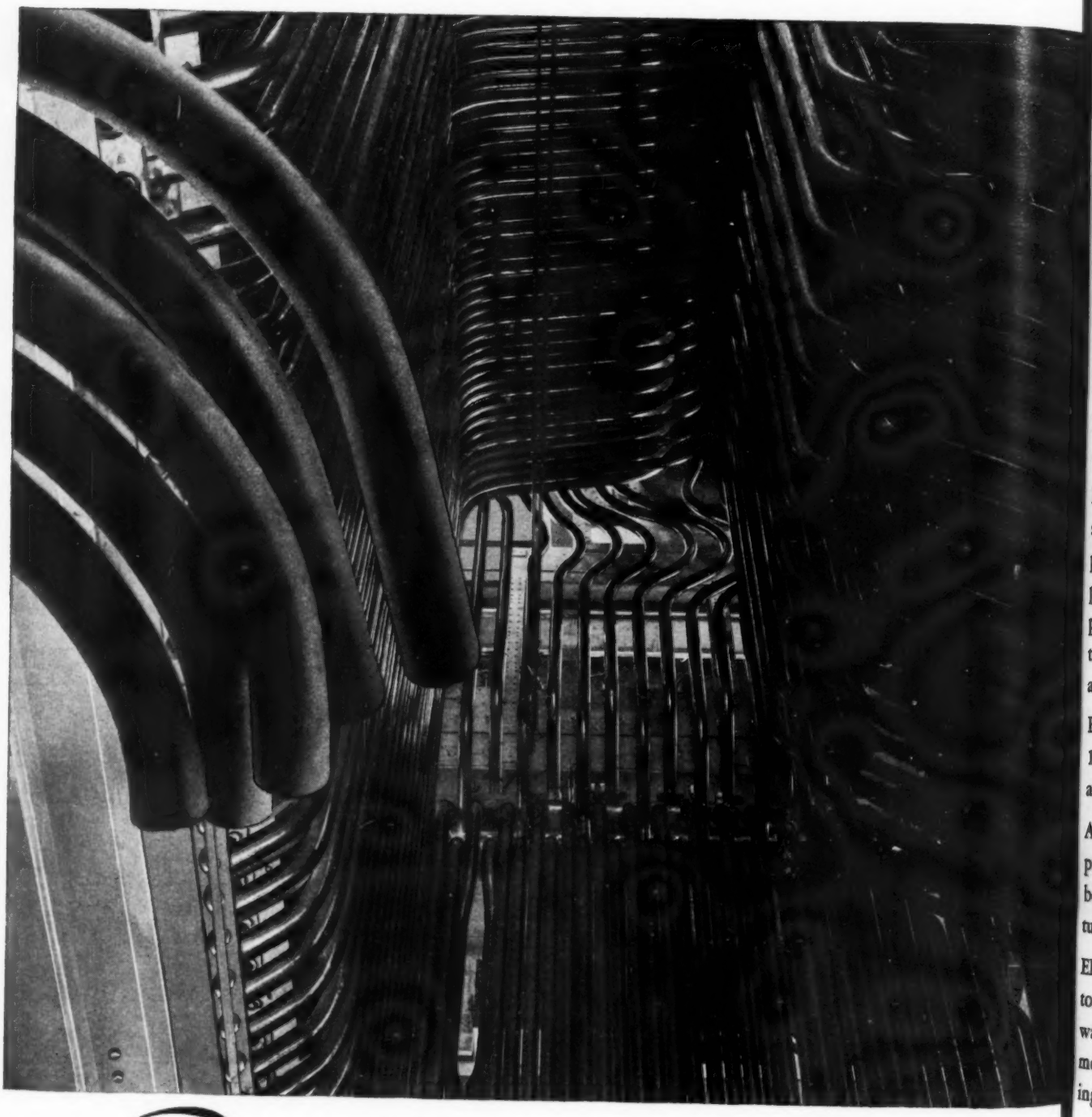
Unit Subs Save Still More Copper

What's more, you can save immense amounts of cable copper by installing safety-enclosed unit substations—including *metal-enclosed* switchgear and *Pyranol* transformers—right at the center of the load area. Power can then be distributed to load centers at relatively high voltage. This means *short* secondary cables—and tons of copper saved.

Ask the nearest G-E office about *standard* G-E switchgear and unit substations. You can save time and copper, and get a new high degree of operating dependability and safety. *General Electric, Schenectady, N. Y.*

GENERAL ELECTRIC

THIS Margin of Safety



Republic

ELECTRUNITE

Reg. U. S. Pat. Off.

MEANS

More Margin for Victory

Our war effort depends upon production. Production depends upon power. And power output depends upon the boiler tubes employed in steam generation.

Hence, boiler tubes are tremendously important—and any extra margin of safety provided for round-the-clock or overloaded operation means just that much more margin for victory.

Republic ELECTRUNITE Tubes afford that extra margin of safety.

Every ELECTRUNITE Boiler Tube is hydrostatically tested well in excess of the 1000-pound A.S.M.E. code requirement—at a pressure within 20% of the minimum yield point of the steel—to make certain that the tube is capable of carrying as much overload as the steel itself can withstand.

For example, a 3″ x 12 ga. tube is tested at 1900 pounds, a 2″ x 13 ga. at 2500 pounds and a 1″ x 13 ga. at 5650 pounds.

Although extremely high in test value, such pressures are safe to use, because they are held below the point where the steel or tube structure might be weakened by excessive test strain.

ELECTRUNITE Tubes help save outage time, too. Their consistent uniformity in diameter, wall thickness, concentricity and ductility means easy, rapid roller expanding and beading over. They weld readily.

More than ten years of use in all types of heat transfer equipment have proved the economy of ELECTRUNITE Tubes. They meet requirements of leading associations and societies—and are included in U. S. Navy and Federal Specifications. Write for further information.

REPUBLIC STEEL CORPORATION
Steel and Tubes Division
Sales Offices • Cleveland, Ohio
GENERAL OFFICES • • CLEVELAND, OHIO
Berger Manufacturing Division • Culvert Division
Niles Steel Products Division • Union Drawn Steel Division
Truscon Steel Company
Export Department: Chrysler Building, New York, New York

REPUBLIC STEEL CORPORATION, STEEL AND TUBES DIVISION, IS THE ONLY PRODUCER OF ELECTRUNITE TUBING

REPUBLIC STEEL PRODUCTION FOR VICTORY

BOILER, CONDENSER AND HEAT EXCHANGER TUBES

B. t. u. Savers – *that will be*

RECORDING THERMOMETERS

Remote Reading—Single and Multiple Pen

Republic thermometers are available for recording temperature of flue gas, temperatures in vats or tanks either open or closed and under pressure, temperatures in pipe lines, refrigeration systems, ovens, kilns or ducts. For unusual conditions, special bulbs are furnished of corrosion resisting metal or with a protective coating.

WRITE FOR DATA BOOK No. 210

FLOW METERS

Electrical Remote Reading Type

Republic electrical type flow meters are available for measuring the flow of all types of liquids and gases. Meter bodies are built for metering fluids at line pressures up to 10,000 lb. per sq. in. and for all ranges of differential pressure. The reading instruments — indicator, recorder and integrator — are of the remote reading type.

WRITE FOR DATA BOOK No. 701

CO_2 METERS

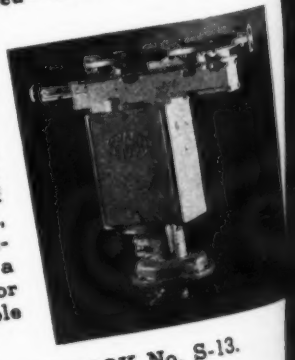
An Automatic Orsat—For Checking Combustion Efficiency

For every fuel and boiler, there is a definite percentage of CO_2 in the flue gas that will assure highest combustion efficiency. Less than this amount indicates an excess of combustion air, causing high stack loss. The CO_2 meter is the only method of accurately determining combustion efficiency.

WRITE FOR DATA BOOK No. 403

REGULATORS

Pressure — Flow — Speed — Level — Ratio



Republic hydraulic or pneumatic type regulators are supplied for the automatic control of pressure, rate of flow, speed of rotation, level of a liquid or the proportioning of two pressures, flows, etc., in a fixed ratio by mechanically operating a valve, damper, rheostat or various types of variable speed transmissions.

WRITE FOR DATA BOOK No. S-13.

BOILER WATER LEVEL CONTROL

Sensitive — Powerful — Stable — Rugged

The Republic boiler water level control system has been especially designed to meet the requirements of modern boiler operation. It is designed to maintain boiler drum water level within ±1 inch of the desired level under normal conditions.

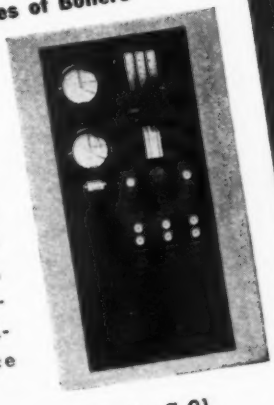
WRITE FOR BULLETIN No. S-50

REPUBLIC
INSTRUMENTS
AND CONTROLS

will help you stretch wartime plant capacity

COMBUSTION CONTROL

For All Sizes and Types of Boilers



Republic automatic combustion control is available for all sizes of boilers, all types of fuel firing, all load conditions and any arrangement of draft equipment. It maintains constant steam pressure, highest combustion efficiency, desired load division, constant furnace draft.

WRITE FOR DATA BOOK No. S-21

PRESSURE REDUCING AND REGULATING VALVES

Pressures To 2500 lb.—Temperatures To 950 F.

Republic turbine type valves are of the gradual-opening, high-lift type. They are built in accordance with A.S.A. standards and can be supplied for all pressures up to 2500 lb. per sq. in. and for temperatures up to 950 F and for any specified capacity. Republic valves will regulate down to 2% of maximum flow.

WRITE FOR BULLETIN No. S-40

DRAFT AND PRESSURE INSTRUMENTS

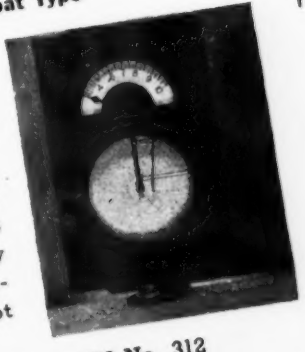
Diaphragm Actuated Any Number and Combination

Proper regulation of draft is one of the most important requirements in obtaining highest combustion efficiency. For indicating and recording drafts, pressures and differentials, Republic dry-bellows type indicators and recorders are supplied for all ranges encountered in furnace operation, in any desired combination.

WRITE FOR BULLETIN No. 802

FLOW METERS

Mechanical Float Type



The Republic mechanical float type meter is a simple, accurate metering device for measuring the flow of steam, water, gas, compressed air, oil, brine and other fluids. It has been designed primarily for installations where remote registration is not required.

WRITE FOR BULLETIN No. 312

DESUPERHEATERS

To Meet Your Specific Requirements. Whatever your nt conditions, you can obtain the necessary operating sibility and accurate regulation of steam temperature with ged, simply-controlled Republic desuperheaters. These e of the venturi type, with ratio or ratio-tank control, the am atomizing type and the mechanical atomizing type.

WRITE FOR DATA BOOK No. S-35

Republic Flow Meters Co.

2222 Diversey Parkway • Chicago, Illinois

Now - "Preventive Care"

WHAT CAUSED THIS BOILER TUBE TO BURN OUT?
Lack of "preventive care," to be sure. But, beyond that, it is our job to track down the real cause of trouble and to separate it from a half dozen other seemingly possible causes. No "amateur detectives" can do this job. It takes scientific knowledge of the highest type and eyes trained to see what others overlook.

is a wartime necessity

Doing "too little, too late" to prevent boiler outages is a poor way to win battles on the production front

IT is probable that the boilers served by every power plant operator who reads this are wholly or in part engaged in making steam for critical war production.

That makes "preventive care" a positive *must*. Nothing else will give such assurance of uninterrupted steam output.

Some operators think they can manage this job alone. Others have partial help. All credit to those who are successful.

But there is something significant in the fact that hundreds of the foremost and best equipped and manned plants in the country wouldn't consider for a moment being without continuous specialized technical assistance. Time after time they've had occasion to see how well it pays.

Hall Laboratories chemists have blazed the trail for "preventive care." The pioneering they have done and are doing in boiler water conditioning forms the foundation for the service we offer today.

Hall preventive care is as broad as its need. Every problem you face in keeping your boilers in prime working condition is directly *shared* by the Hall Field Engineer who works with you. It is his responsibility, and that of Hall Laboratories behind him, to see that everything possible is done to help prevent troubles caused by water.

You have never faced a time when there was such a patriotic necessity to conserve every working part of your equipment and keep it in top producing condition. May we explain how we could help you to do it?

HALL LABORATORIES, INC. · HAGAN BUILDING · PITTSBURGH, PA.

A subsidiary of Hagan Corporation

Hall Service in a Nutshell

At your immediate disposal are placed the technical knowledge and facilities of the pioneering leaders in scientific boiler water conditioning. In addition, with your full cooperation, Hall Service:

1. Minimizes boiler outages caused by water.
2. Helps maintain highest efficiency.
3. Establishes non-embrittling water.
4. Minimizes carryover.
5. Prevents corrosion in boilers and associated equipment.
6. Prevents deposition in water lines and cooling systems.

HALL SYSTEM *of Boiler Water Conditioning*

HAGAN
HALL
BUROMIN
CALGON

Steam Hammer Load couldn't make boiler pressure "Nervous" or "Jumpy"

OUR STORY this month takes us to a steel plant. The steam demand chart is typical—a virtual blow-by-blow description of the steam hammer load. But now look at the corresponding boiler pressure chart. In that steady line you see a strong characteristic of Taylor Stokers—their ability to meet widely fluctuating steam demands with a negligible sacrifice of boiler pressure.

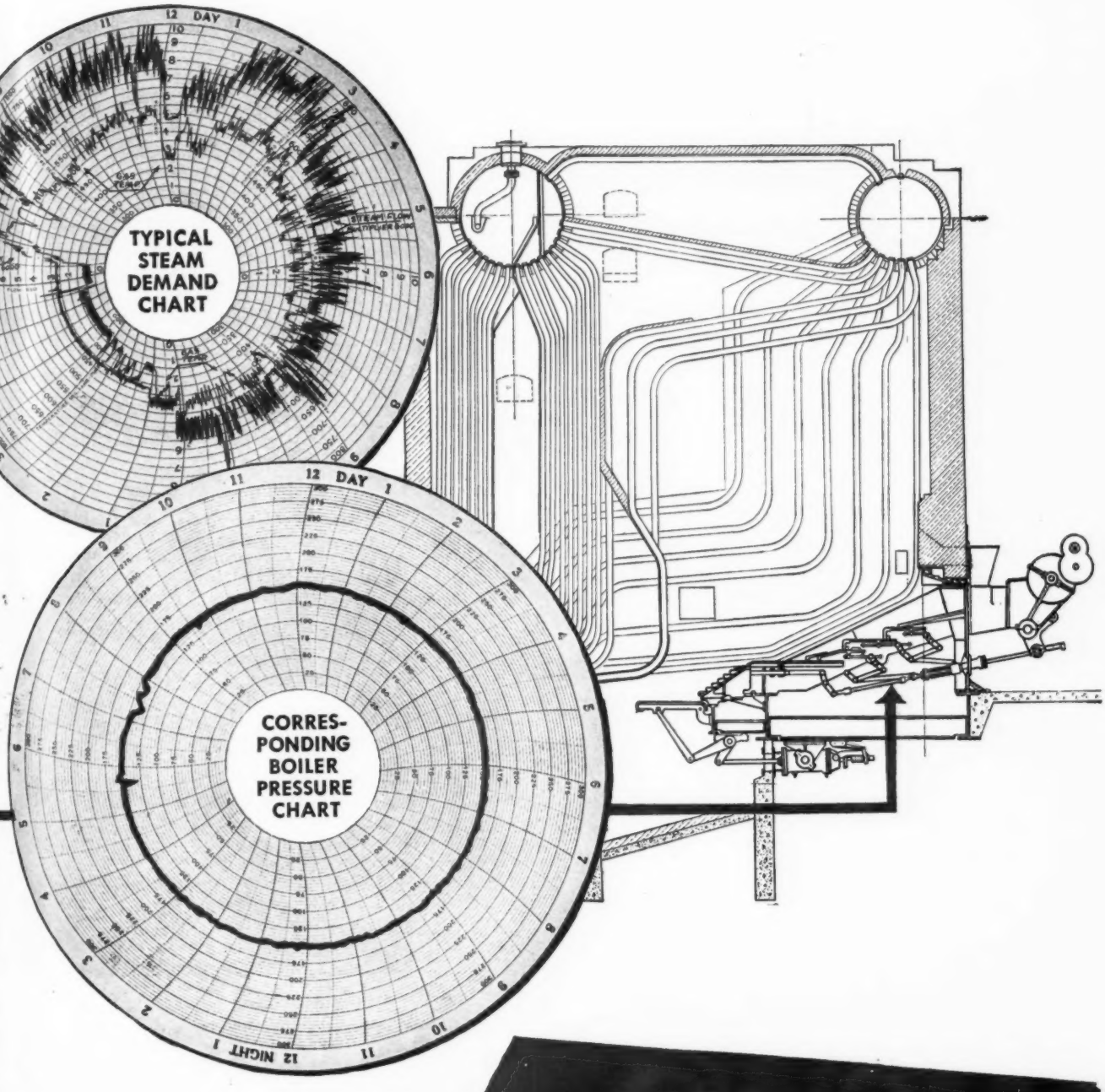
The installation which first went on the line early in 1942 has consistently met all requirements of steaming flexibility and efficiency.

JUDGE THE SELECTION OF FUEL FIRING EQUIPMENT BY THESE TWELVE POINTS

1. **RELIABILITY**—the ability to operate with minimum outage and minimum standby equipment.
2. **CAPACITY**—the ability to provide adequate prime capacity ratings, with sufficient reserve capacity for emergencies.
3. **MAINTENANCE**—the ability to operate continuously with minimum repair costs.
4. **FLEXIBILITY**—the ability to follow the steam demand upward or downward . . . quickly and without sacrificing efficiency.
5. **EFFICIENCY**—the proved **dollar** efficiency (**total** cost of steam production) as shown by actual performance in similar installations.
6. **OPERATION**—the ability to operate continuously, the number and type of operations required, the ease of combustion adjustments, etc.
7. **ADAPTABILITY**—the ability to meet special and limiting conditions, present and future—structural limitations, utilization of present equipment, growth and change of power service demands.
8. **FUEL FLEXIBILITY**—the ability to burn efficiently and easily fuels from many sources having widely varying characteristics.
9. **REFUSE DISPOSAL**—the ability to economically eliminate ash or refuse and the opportunities of disposal at low cost, no cost, or profit.
10. **STACK DISCHARGE**—the practical elimination of "smoke nuisance" without special equipment.
11. **SPACE REQUIREMENTS**—the ability to conform to existing or future space limitations, to short and wide or long and narrow furnaces. Also the accessibility of component parts for maintenance and operation.
12. **OBSOLESCENCE** — the adaptability of the equipment toward possible future modernization with minimum of complication and outage.

AMERICAN ENGINEERING

PHILADELPHIA • PENNSYLVANIA

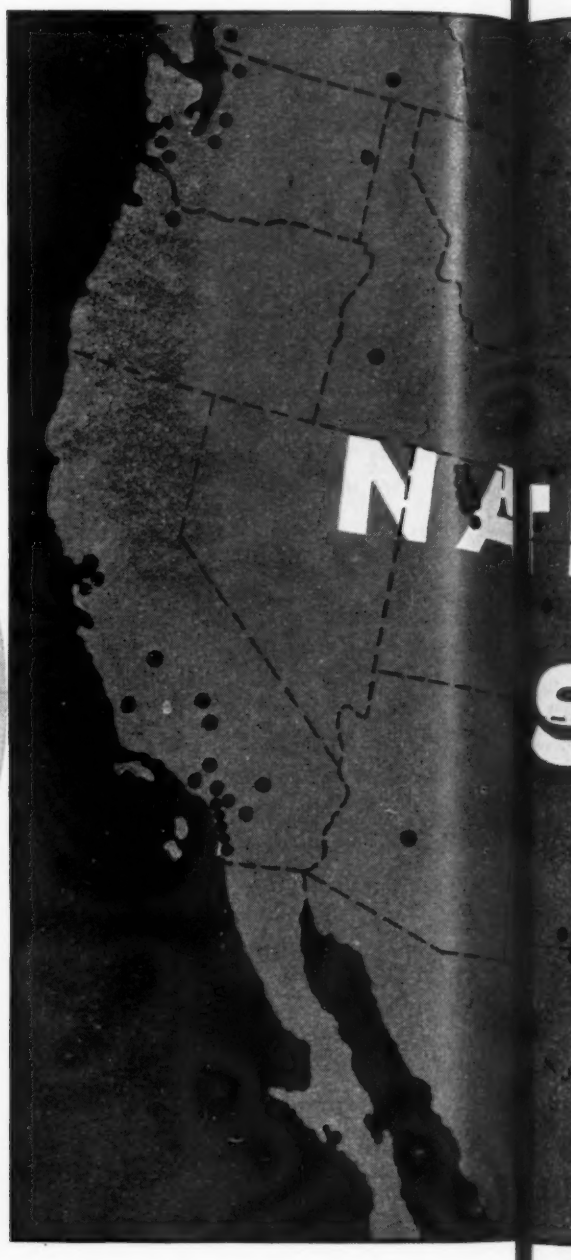


A-E-CO TAYLOR STOKERS
LO-HED HOISTS
HELE-SHAW FLUID POWER
MARINE DECK AUXILIARIES

A-E-CO
TAYLOR STOKER

COMPANY

Æ CO 75th ANNIVERSARY



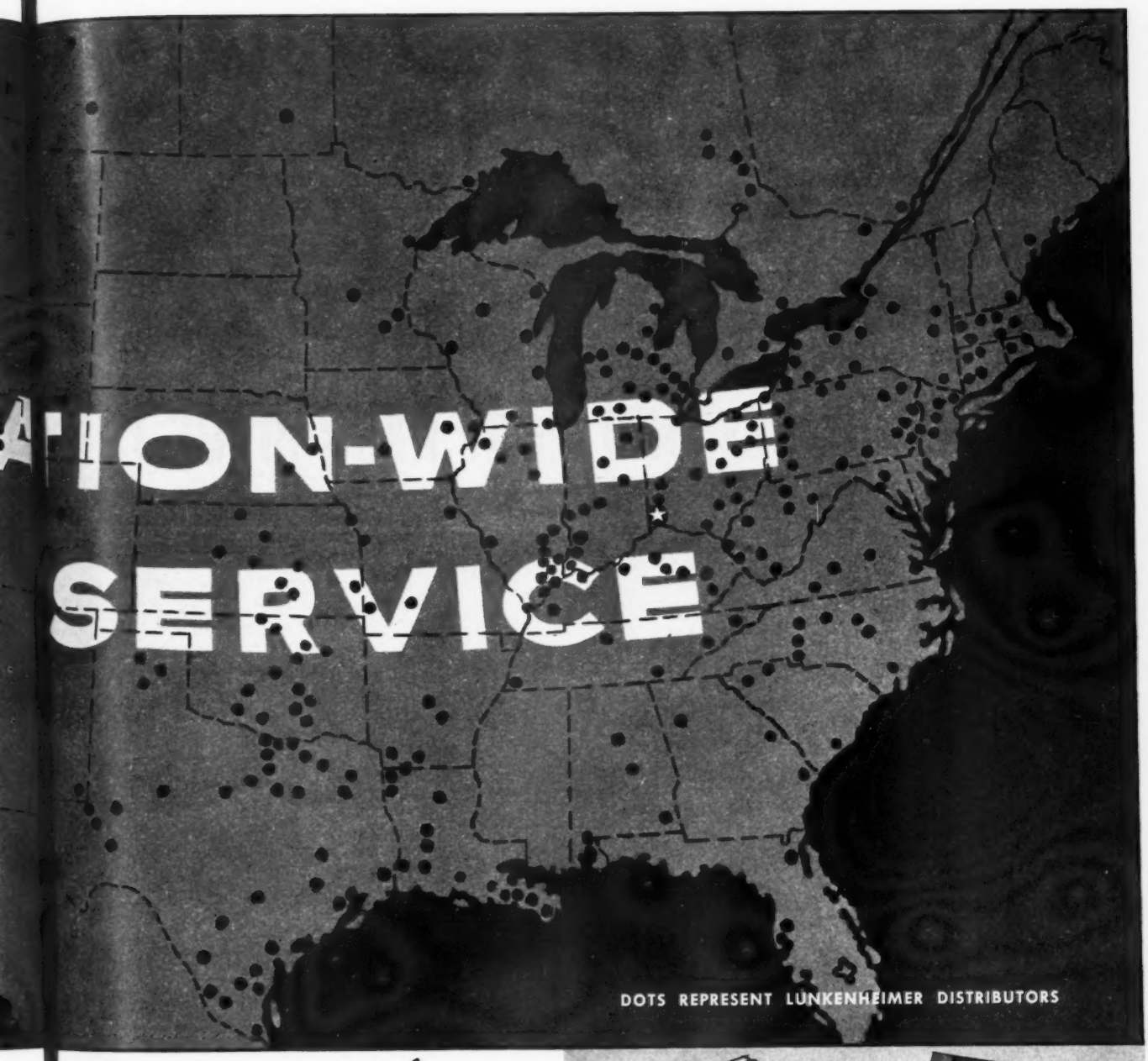
Wherever there's WAR ACTIVITY *There's a* DISTRIBUTOR

The distributor is rendering an indispensable service these days. With his complete familiarity with requirements and sources of supply, he is helping hard-pressed procurement offices to obtain vitally needed equipment and supplies for the Army, Navy, Maritime Commission and Air Force... not to mention his services to the thousand-and-one other industries engaged in war work.

He's alive to the needs of the times and his wide experience qualifies him as the logical force to ferret out those needs... he's here, there and everywhere—any hour of the day or night. He knows that he justifies his existence only in the measure that he renders service.

Once he receives an order, he is, by the very nature of his business, the best expediter in the world, because his organization is *trained* to get things through in the shortest possible time.

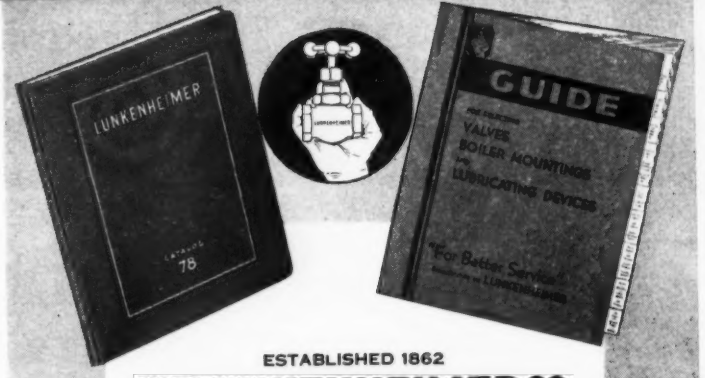
LUNKENHEIMER



erving it...

ng ago, Lunkenheimer recognized the distributor as the st efficient and economical means of marketing its oducts and built up nation-wide distribution through ding supply houses. We salute these distributors for outstanding job they are doing in helping to speed war production.

• • •



ESTABLISHED 1862

THE LUNKENHEIMER CO.

"QUALITY"

CINCINNATI, OHIO. U. S. A.

NEW YORK CHICAGO
BOSTON PHILADELPHIA

EXPORT DEPT. 318-322 HUDSON ST., NEW YORK

VALVES

No. 28-102-43

Scovill Tube News

Vol. 1 SCOVILL MANUFACTURING COMPANY, Waterbury, Conn. No. 5

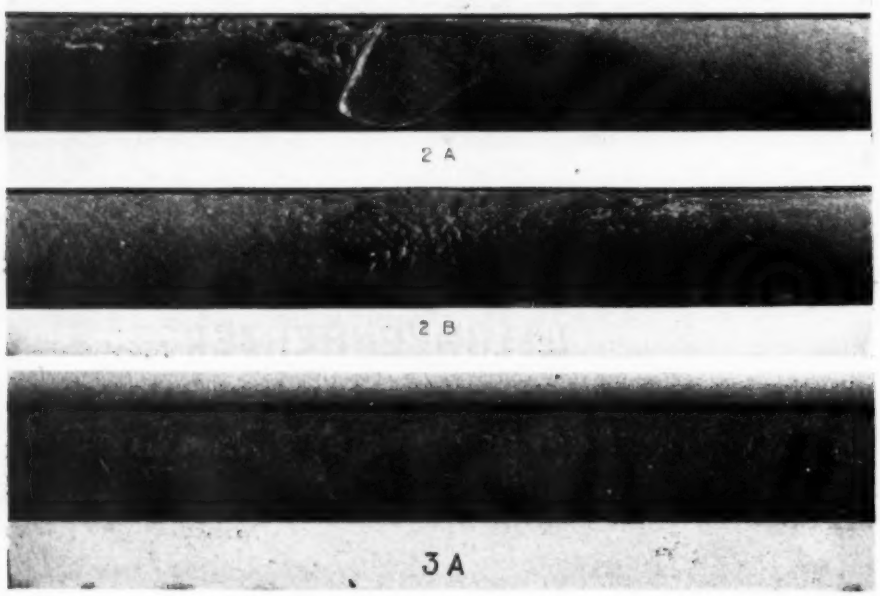
Important Types of Corrosion Attack On Condenser and Heat Exchanger Tubes

Deposit Attack

Corrosion of the "deposit attack" type may be considered as a special form of "concentration cell" action which is directly due to the settling out or lodgment on the tube wall of sand, mud, coke, stones, wood, shells, flakes of iron scale, etc. Under such conditions, part of the metal surface becomes shielded or protected by the deposit and usually becomes anodic to adjacent metal areas; intense pitting at such shielded areas is likely to occur. If the deposit is of sufficient size to interfere seriously with the flow of the circulating medium, turbulence, air separation and erosion-corrosion of the down-stream side of the tube may take place. The two halves of a condenser tube shown in Fig. 2a and b were sectioned lengthwise and opened so that the entire inside surface could be inspected. This tube had failed in service as a result of "deposit attack". Damage in this case was caused by a stone which entered the tube with the circulating medium and became tightly wedged against the tube wall. Section 2A shows the position of this stone quite clearly and also shows the severe action which has taken place in the immediate vicinity of the obstruction. Severe erosion of the tube wall directly opposite the stone (Section 2B) has taken place and has been directly responsible for the perforation and failure of the tube. Another example of "deposit attack" of a condenser tube is illustrated in Fig. 3A. This photograph was made of a half section of the inside surface of a condenser tube. For the most part, the surface of this tube is coated with a green corrosion product; localized pitting is evident, however, particularly at the extreme right end of the tube, as a result of foreign deposits on the tube wall.

Common Causes of Corrosion Further Analyzed in Scovill's War-time "Service in Manuals"

The continuing study of causes of corrosion appearing on these pages is part of Scovill's broad "service in manuals" available to all tube users in this war-time period — a service which has proved to be increasingly useful in conservation of scarce tube metals. Reprints of previous issues of "Tube News" are available on request, together with Scovill's new "Condenser Tube Booklet" covering the entire range of Condenser and Heat Exchanger Tube problems. Address Scovill Manufacturing Company, 13 Mill St., Waterbury, Conn.



Plug- and Layer-Type Dezincification

Brasses containing less than 85% of copper may undergo corrosion which results finally in the gradual replacement of the brass by a spongy, porous copper deposit. This deposit may occur locally, developing into "plugs" of copper, or it may occur uniformly over the tube surface — in which case it is designated as "layer-type dezincification". Conditions which favor dezincification of condenser tubes are:

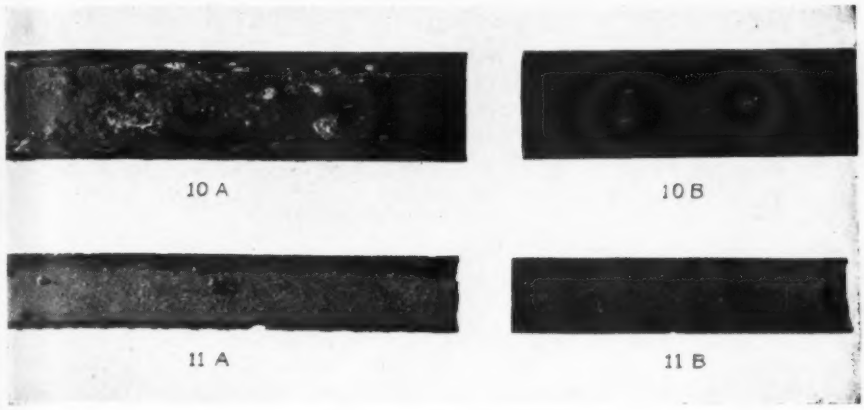
(1) Contact with waters slightly acid in character and of a low degree of aeration.

(2) Relatively low velocity of water over the tube surfaces, or stagnant water in tubes.

(3) Relatively high temperatures.

(4) Certain types of permeable scales on the metal surface.

Dezincification may be considered as a special form of "concentration cell" corrosion in which anodic areas on the tube wall are first corroded with the formation of Copper and Zinc salts; after a sufficient concentration of Cupric ions accumulates at the metal surface, secondary reactions occur between the metal and solution, with reduction of Cupric ions to Cuprous ions, followed by reduction of Cuprous ions to metallic copper. The two pieces of tube shown in Fig. 10a and b have been cut from a tube which failed in service as a result of layer-type dezincification. The deposit of scale and corrosion product at the inside surface of sample 10a has not been disturbed, whereas the deposit has been removed from sample 10b to bring out more clearly the condition of the metal. The extensive layer-type dezincification of this sample is not clearly defined in the photograph, due to the absence of color in the reproduction; however, a close examination of the edge section of 10b does reveal many light scalloped areas (in contrast to the dark color of the brass) which are in reality porous deposits of copper. An illustration of "plug-type" dezincification of a tube is shown in Fig. 11a (with original deposit of scale and corrosion product) and 11b (same tube with deposit removed). Here, again, the red copper color of the "plugs" is not reproduced, but the several dark areas through the cross section of 11a each represent a copper plug which has penetrated the tube wall.



Galvanic Action

The indiscriminate use of dissimilar metals and alloys in any service, when they make good contact and are also subjected to a conducting medium, may lead to the early failure of the less noble or anodic member of the couple. In the design of equipment which is to be used for handling liquids, moist gases or vapors, therefore, the possibility of galvanic corrosion should be given careful thought. The factors which must be considered in corrosion of this kind have already been discussed. It is perfectly safe to design equipment of dissimilar metals and alloys, provided necessary attention is given to the factors which might accelerate galvanic corrosion. In heat-exchanger units containing brass tubes, other parts of the unit are usually constructed of cast iron or steel, and yet galvanic corrosion is seldom a source of trouble in such units. F. L. LaQue and G. L. Cox, in a paper on "Some Observations of the Potentials of Metals and Alloys in Sea Water", published in Proceedings A. S. T. M. Vol. 40, 1940, Pg. 670–687, have given the relative position of about forty-four common metals and alloys in a galvanic series referring to sea water. This series is of sufficient interest to be given as follows:

GALVANIC SERIES IN SEA WATER

Magnesium
Magnesium alloys
Zinc
Galvanized steel or galvanized wrought iron
Aluminum 52SH
Aluminum 4S
Aluminum 3S
Aluminum 2S
Aluminum 53S-T
Alclad
Cadmium
Aluminum A17S-T
Aluminum 17S-T
Aluminum 24S-T
Mild steel
Wrought iron
Cast iron
Ni-Resist
13% chromium stainless steel type 410 (active)
50-50 lead tin solder
18-8 stainless steel type 304 (active)
18-8-3 stainless steel type 316 (active)
Lead
Tin
Muntz metal
Manganese bronze
Naval brass
Nickel (active)
Inconel (active)
Yellow brass
Admiralty brass
Aluminum bronze
Red brass
Copper
Silicon bronze
Ambrac
70-30 copper nickel
Comp. G-bronze
Comp. M-bronze
Nickel (passive)
Inconel (passive)
Monel
18-8 stainless steel type 304 (passive)
18-8-3 stainless steel type 316 (passive)

ARMY E NAVY

Limitation order L-154 issued by the OPM, limits the use of nonferrous condenser tubes in land power stations to Muntz metal for fresh water plants, and Admiralty metal for salt water plants. No nonferrous metals containing more copper and more tin than these two are permitted by the order.

Scovill
MANUFACTURING COMPANY
WATERBURY, CONN.

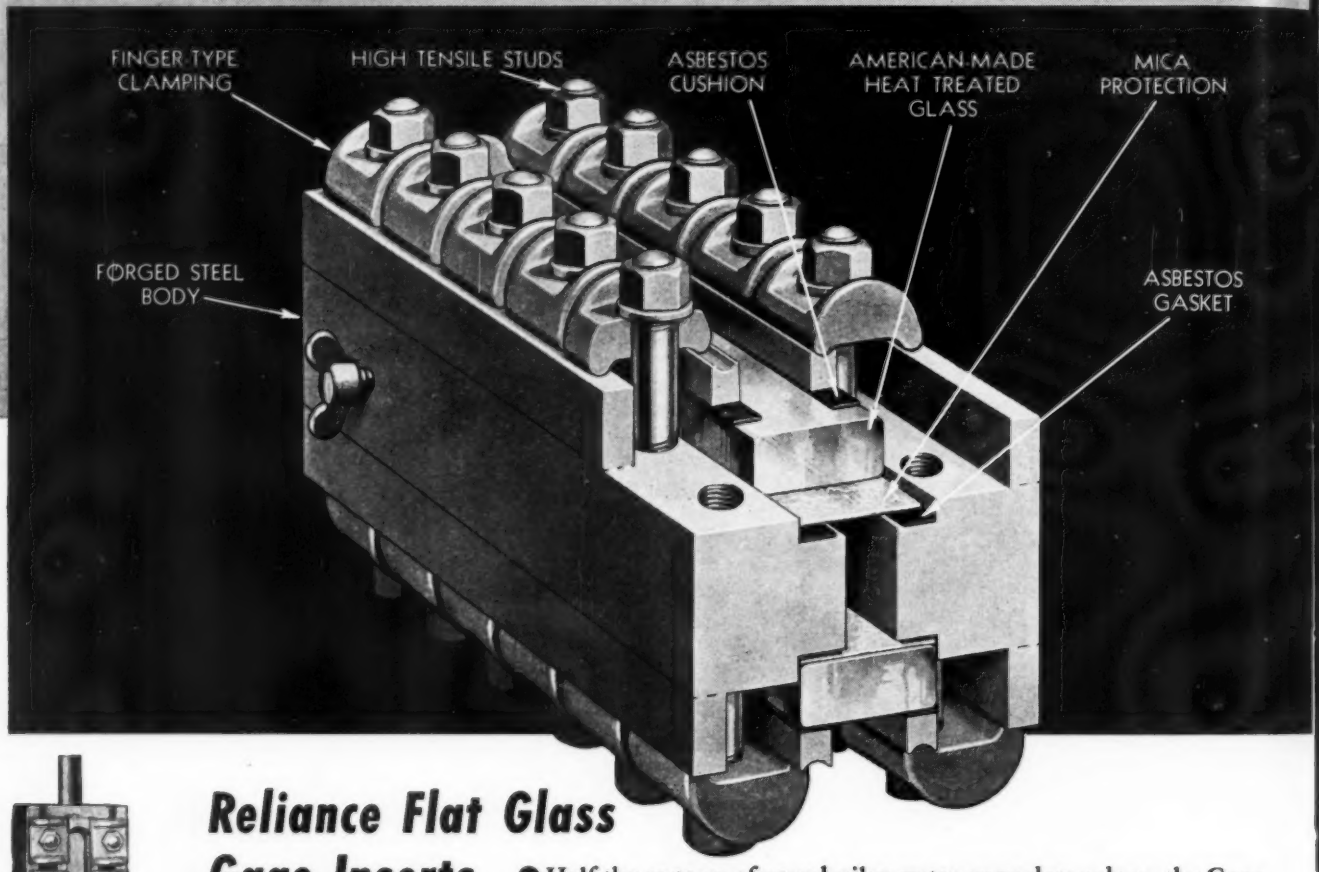
SCOVILL CONDENSER TUBES

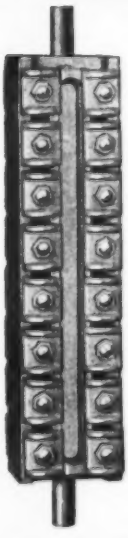
ONE PRODUCT... THREE SERVICES

Service in Manuals ... Service in Metals ... Service in Men

How's the *Maintenance Quality*

On this factor depends its ability to give you





Reliance Flat Glass Gage Inserts

● Half the success of your boiler water gage depends on the Gage Insert and its *Maintenance Quality.* The Reliance Mica-protected Flat Glass Insert is an efficient, shatter-proof indicator, built for safety and clear readability. A practical product in service on hundreds of boilers, this design has proved its excellence where maintenance must be accomplished under difficult conditions.

Heat-treated flat glass, carefully selected, is assembled with sheet of mica to prevent erosive effects of steam and water, in heavy forged steel housing. Finger-type clamps held by alloy studs and nuts provide a safe, leak-tight assembly that any workman can dismantle for cleaning or other maintenance.

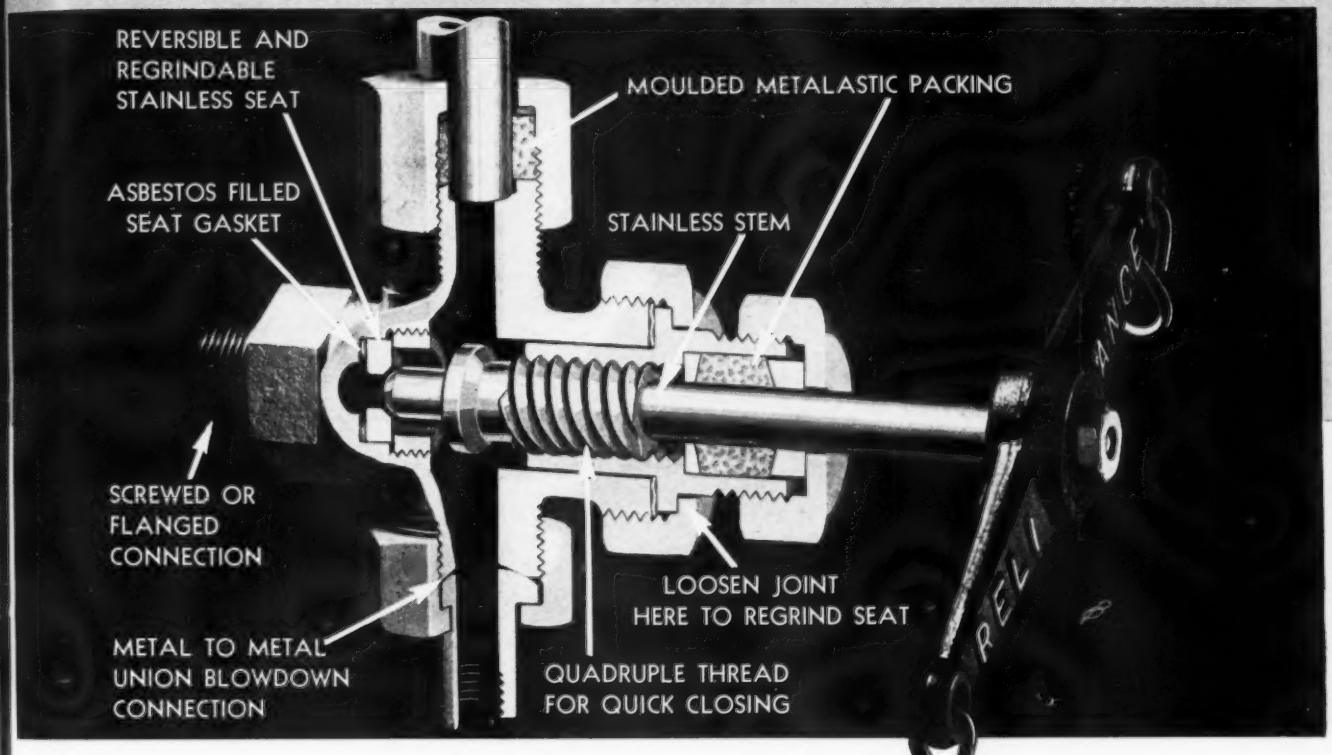
Reliance Flat Glass Inserts are made in a complete range of visibility lengths, for all boiler purposes.

Since 1884

Reliance

of your Water Gage Equipment?

safe, accurate water level indication constantly

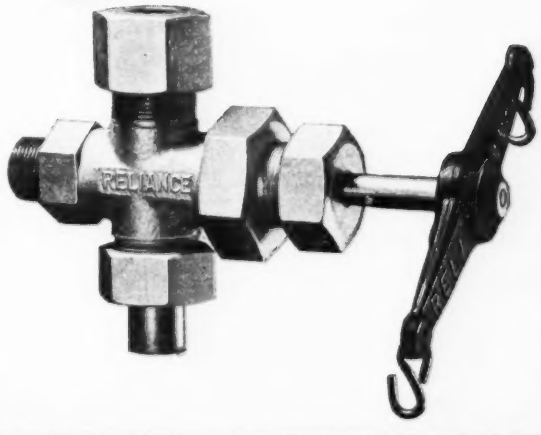

REVERSIBLE AND REGRINDABLE STAINLESS SEAT
MOULDED METALASTIC PACKING
ASBESTOS FILLED SEAT GASKET
STAINLESS STEM
SCREWED OR FLANGED CONNECTION
LOOSEN JOINT HERE TO REGRIND SEAT
METAL TO METAL UNION BLOWDOWN CONNECTION
QUADRUPLE THREAD FOR QUICK CLOSING

Reliance Gage Valves

● *Maintenance Quality* likewise is of vital importance in your gage valves. Maintenance is extremely low on Reliance Gage Valves . . . but when check-up time does come . . . it's not much of a chore.

The forged steel body houses a valve that has all-high-quality elements: stainless metal stem and renewable-reversible seat; ample stuffing box space and high-grade moulded packing rings for high temperature service; quadruple thread on stem opens or closes valve in a quarter turn—an important aid in preventing leaks and steam-cutting.

This and other valves in the Reliance Line contribute to clean-cut, leakless water gage service—a credit to any boiler room. Models that meet all requirements are described in Bulletin 418.



BOILER SAFETY DEVICES

THE RELIANCE GAUGE COLUMN CO.
Cleveland, Ohio

STEAM PRODUCTION

vs.

MAINTENANCE

Steam and yet more steam for the production of ships, planes, tanks, guns and munitions has been the vexing problem for two long years. Installation of new power plant equipment has been negligible — shortage of material prevent it.

One solution remains — the harder driving of existing equipment without outages for repairs. It is to the everlasting credit of Power Maintenance Crews that plant shutdowns for lack of steam have been virtually unknown.

Much of the nation's steam generating equipment is old; it is driven at a higher rate than it was designed for, with the result that greater maintenance and longer shut-downs are inevitable.

How then to insure maximum production?

The Answer is . . . PREVENTIVE MAINTENANCE

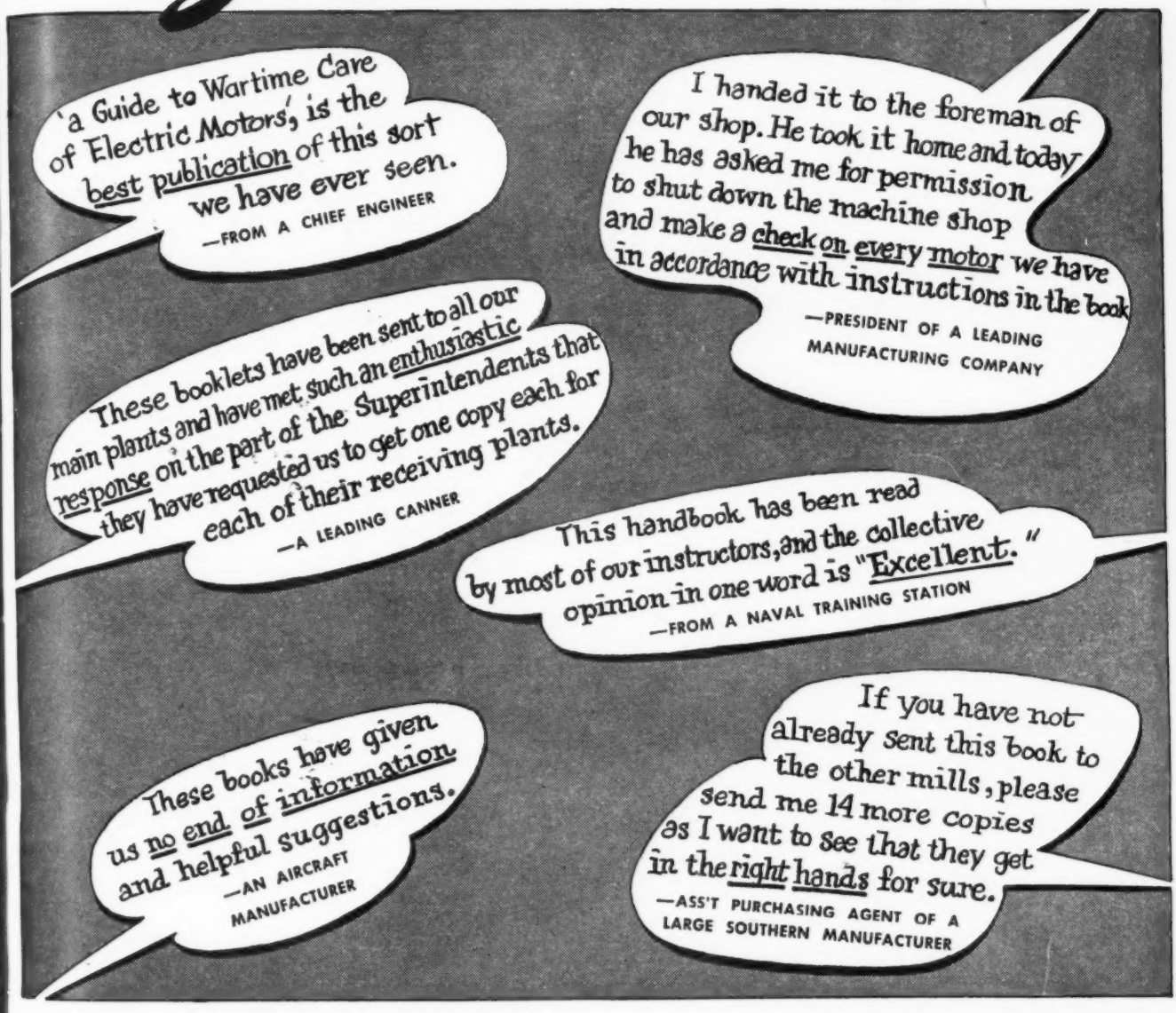
Plan carefully, inspect continuously; take every possible stitch in time. Consult manufacturers of your equipment as they have valuable suggestions to offer.

SEND FOR BULLETIN ON
"PREVENTIVE MAINTENANCE"

FOSTER WHEELER CORPORATION • 165 Broadway, New York, N. Y.

FOSTER WHEELER

Success Story!


'a Guide to Wartime Care of Electric Motors,' is the best publication of this sort we have ever seen.
—FROM A CHIEF ENGINEER
I handed it to the foreman of our shop. He took it home and today he has asked me for permission to shut down the machine shop and make a check on every motor we have in accordance with instructions in the book
—PRESIDENT OF A LEADING MANUFACTURING COMPANY
These booklets have been sent to all our main plants and have met such an enthusiastic response on the part of the Superintendents that they have requested us to get one copy each for each of their receiving plants.
—A LEADING CANNER
This handbook has been read by most of our instructors, and the collective opinion in one word is "Excellent."
—FROM A NAVAL TRAINING STATION
These books have given us no end of information and helpful suggestions.
—AN AIRCRAFT MANUFACTURER
If you have not already sent this book to the other mills, please send me 14 more copies as I want to see that they get in the right hands for sure.
—ASS'T PURCHASING AGENT OF A LARGE SOUTHERN MANUFACTURER

NINE MONTHS AGO Allis-Chalmers offered free to U. S. industry a *new* kind of maintenance book ... "A Guide to Wartime Care of Electric Motors."

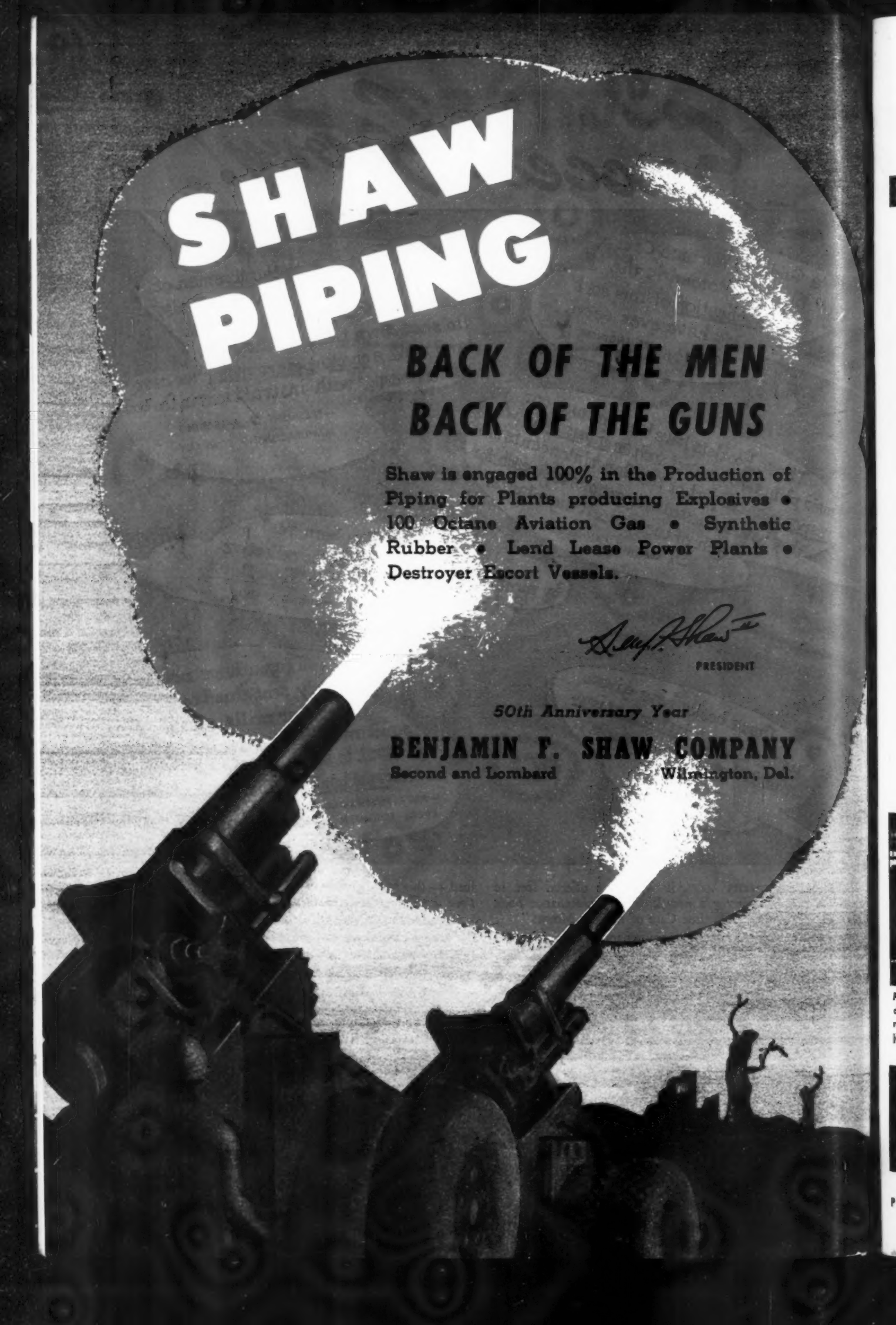
Setting up as targets for maintenance the 9 main enemies of motor life — dust, stray oil, moisture, friction, misalignment, vibration, uneven wear, overload, underload — this new handbook gave simple, easy-to-get, *wartime* directions for fighting them.

Result? Over *100,000* copies are already in use by the armed forces and war industry — and new requests pour in daily. If you haven't yet obtained *your* free copy, write ALLIS-CHALMERS, MILWAUKEE, WIS. A 1592

ALLIS-CHALMERS MOTORS

When you do need new motors, look into the strength, solidity and all-around protection of the new "Safety Circle"—protected top, sides, ends and bottom.

AC WE WORK FOR VICTORY WE PLAN FOR PEACE


SHAW
PIPING
BACK OF THE MEN
BACK OF THE GUNS
Shaw is engaged 100% in the Production of Piping for Plants producing Explosives • 100 Octane Aviation Gas • Synthetic Rubber • Lend Lease Power Plants • Destroyer Escort Vessels.
PRESIDENT
50th Anniversary Year
BENJAMIN F. SHAW COMPANY
Second and Lombard
Wilmington, Del.

Alloys in ENGINEERING STEELS

When chromium, silicon, manganese, molybdenum, tungsten, nickel, or vanadium are added to a plain carbon steel, the steel acquires new properties. Depending on the alloys added, and the amount, the steel is made stronger, tougher, harder, more heat-resistant and more corrosion resistant. Such steels are called alloy steels. When these steels contain less than 5 per cent alloy and are used for mechanical parts, they are usually known as engineering steels. Shown here are some typical uses of engineering steels.

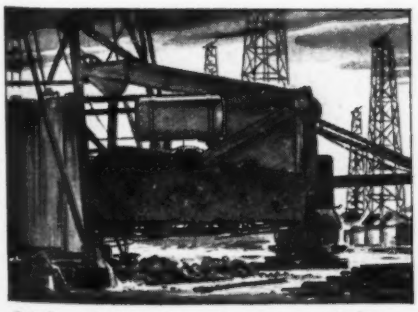
Minimum effective amounts of these alloys, largely obtained from scrap, are used in the wartime alternate National Emergency steels, which are in many cases satisfactory substitutes for the standard alloy steels.

However, because of service conditions in many applications, the standard steels of higher alloy content must be used. In ball bearings, for example, where abrasive wear is a problem, the usual steel is SAE 52100, which contains 1.2—1.5% chromium and 0.30—0.50% manganese.

For more than 35 years we have produced the ferro-alloys used in making alloy steels. If you have a problem in the selection, fabrication, or use of an alloy steel, call on us.

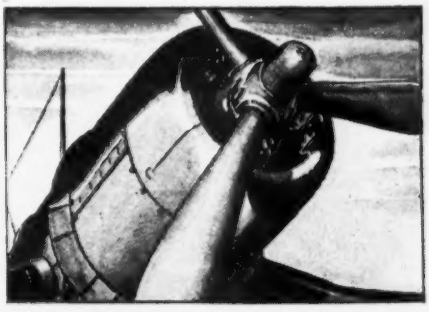
BUY UNITED STATES WAR BONDS AND STAMPS

Trucks . . . Engineering steels are used for transmission gears, spline shafts, rocker arms, shackle bolts, leaf springs, crankshafts, differential drive pinions, steering arms and knuckles, axles, and connecting rods.



Petroleum Equipment . . . Pressure vessels, pipes, draw works shafting, drill collars, kelly bars, rotary table shafts, slush pump rods, and tool joints are usually made of engineering steels.

Machine Tools . . . Engineering steels are used for precision lead screws, spindles, toolholders, gears, collets, feed fingers, cams, shaftings, pneumatic toolholders and pistons.



Planes. . . Propeller blades and shafts, connecting rods, shafts, rocker arms and gears, cylinder liners, tubing, hydraulic parts, and structural parts are made of engineering steels.

ELECTRO METALLURGICAL COMPANY
Unit of Union Carbide and Carbon Corporation
30 East 42nd Street UCC New York, N. Y.
In Canada: Electro Metallurgical Company of Canada, Limited, Welland, Ontario

Electromet
Trade Mark
Ferro-Alloys & Metals

THIS LITTLE TRAP

WRITE FOR

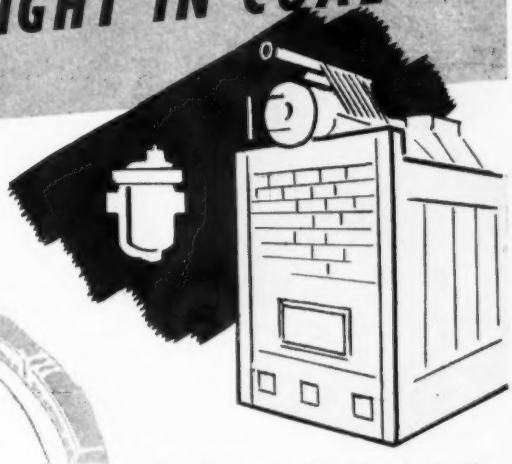
The Armstrong Steam Trap Book, **a valuable guide to good condensate drainage practice. For additional helpful trap maintenance and hookup data, ask for new *Service Guide*.**

ARMSTRONG

is worth annually

10 TIMES ITS WEIGHT IN BOILER METAL

1000 TIMES ITS WEIGHT IN COAL



Based on a saving of only 25 lbs. of steam per hour per trap, the amount of boiler metal necessary to generate this much steam would be as much as ten or more times that used in the trap.

THE fuel-saving, labor-saving, money-saving advantages of Armstrong Steam Traps, important to prosperity in peacetime, have become vital weapons in wartime.

Based on conservative records of steam savings secured by users of Armstrong Traps, it is estimated that 100,000 Armstrong Traps would make the following contributions to the war effort:

SAVE 14,000 carloads of coal in one year of 12 hour days.

OR, save the oil carried by 68 5000-ton tankers.

SAVE ten or more times their weight in boiler metal.

SAVE 100,000 man days a year in maintenance and operation alone, with no attempt made to estimate manpower savings made possible throughout a plant where the output of steam-consuming units is increased from 10 to 33% and more.

ADD to these advantages, the increased production, higher temperatures and closer control of processing made possible by Armstrong Traps and you'll agree they are true warriors against the aggressor.

There is an Armstrong Representative near you to discuss your condensate drainage requirements, or write direct.

Sixty-eight 5000-ton tankers would be required to carry the oil that could be saved by 100,000 Armstrong Traps.

•

The amount of coal that could be saved would be the amount carried by a train of 14,000 cars—seven tons per 14 lb. trap!

ARMSTRONG MACHINE WORKS

812 Maple Street • Three Rivers, Michigan

Tested Capacity **STEAM TRAPS**

NEW TOTALLY ENCLOSED TRI-CLAD MOTOR

FULLY ARMORED AGAINST THE ENTRY OF DESTRUCTIVE MATERIALS—RESISTANT TO CORROSION AND EXTERNAL DAMAGE

On this new member of the Tri-Clad motor family, end shields and frame are solid cast iron, smoothly contoured and tightly fitted. Ball bearings are protected by a rotating-labyrinth bearing seal—against damaging dusts or liquids. The leads are sealed in compound in a cast-iron pocket in the frame. Inside, the motor has all the extra-protection features of Tri-Clad open motors, such as Formex* wire.

An outstanding feature of these new motors is that their mounting dimensions are interchangeable with those of open motors of like rating.

For complete information on the totally enclosed Tri-Clad, see your G-E representative, or write to General Electric Co., Schenectady, N. Y.

*Reg. U.S. Pat. Office

FRAME SIZES

Hp	Rpm	Poly-phase	Single-phase
1/2	900	204	
3/4	1200	203	204
3/4	900	224	
1	1800	203	203
1	1200	204	
1	900	225	
1 1/2	3600	203	203
1 1/2	1800	204	204
1 1/2	1200	224	
2	3600	204	204
2	1800	224	

FOR "CRUEL" SERVICE CONDITIONS LIKE THESE

(Meeting requirements of WPB Motor Conservation Order L-221)

DESTRUCTIVE DUSTS*

Where rock dust, metal filings, powdered chemicals, or other finely divided materials are present in destructive quantities.

CORROSIVE FUMES*

Where motors are exposed to corrosive acids and alkalies in liquid or vapor form, such as on mixers in chemical pilot plants.

GUMMY, VISCOUS MATERIALS

In working with paints, oils, syrups, and other materials which might "gum up" the interior of an open motor.

SUPERSATURATED ATMOSPHERES

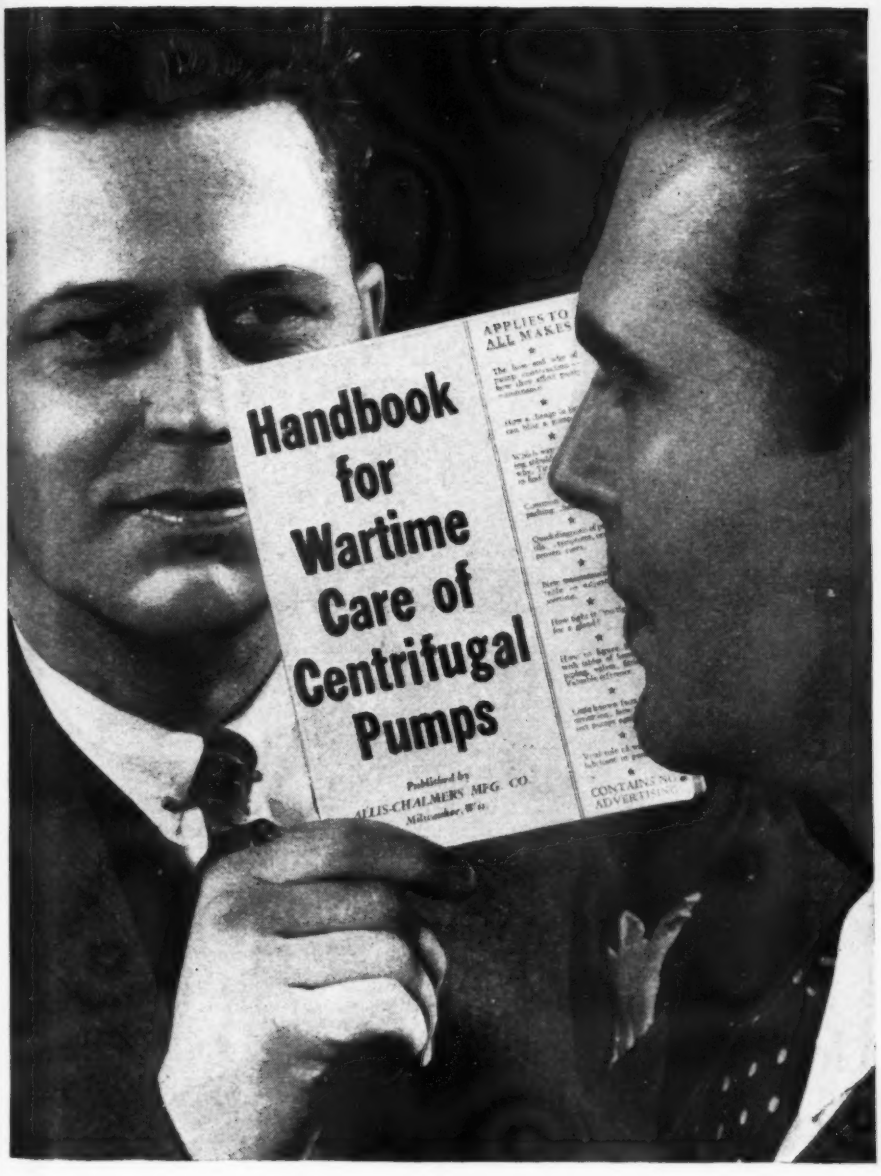
Where motors must operate without fail in areas filled with steam, water vapor, oil droplets. Also out of doors in humid, stormy climates.

* In addition to this *standard* totally enclosed Tri-Clad motor, G. E. can furnish *explosion-proof* types, tested and listed by Underwriters' Laboratories, Inc., for (1) hazardous dusts, such as magnesium dust, coal dust, grain dust, (2) hazardous fumes, such as gasoline.

GENERAL ELECTRIC

750-214-8030

Pump Book Makes News!



Contains no advertising— applies to all makes — copies mailed free of charge. Use it to make present pumps last. And when you *do* need new pumps, look into the extra efficiency, ruggedness and long life of Allis-Chalmers centrifugal pumps — the famous "Electrifugal" . . . and all types for every purpose.

ALLIS-CHALMERS
MILWAUKEE

WE WORK FOR VICTORY — WE PLAN FOR PEACE

HOW TO MAKE EQUIPMENT WORKING ROUND THE CLOCK LAST IS INDUSTRY'S MOST DISCUSSED SUBJECT. MOST DISCUSSED BOOK IS A-C'S NEW PUMP MAINTENANCE GUIDE!

NOW THAT PUMPS are working 2 and 3 times as many hours a week as in peacetime, *they need wartime care* . . . the kind set forth in Allis-Chalmers new "Handbook for Wartime Care of Centrifugal Pumps"!

We contain and direct the spinning liquid with a casing...

By building a pump on paper, this new handbook takes a *fresh* look at pump anatomy. Contents include new preventive maintenance tips, a guide to spotting trouble, a new *war* timetable for pump care, valuable tables. Tear out the coupon below and send in now for *your* free copy!

ALLIS-CHALMERS MFG. CO.
Milwaukee, Wisconsin

Gentlemen:

Yes, I would like to receive *free of charge* a copy of your "Handbook for Wartime Care of Centrifugal Pumps".

(Name)

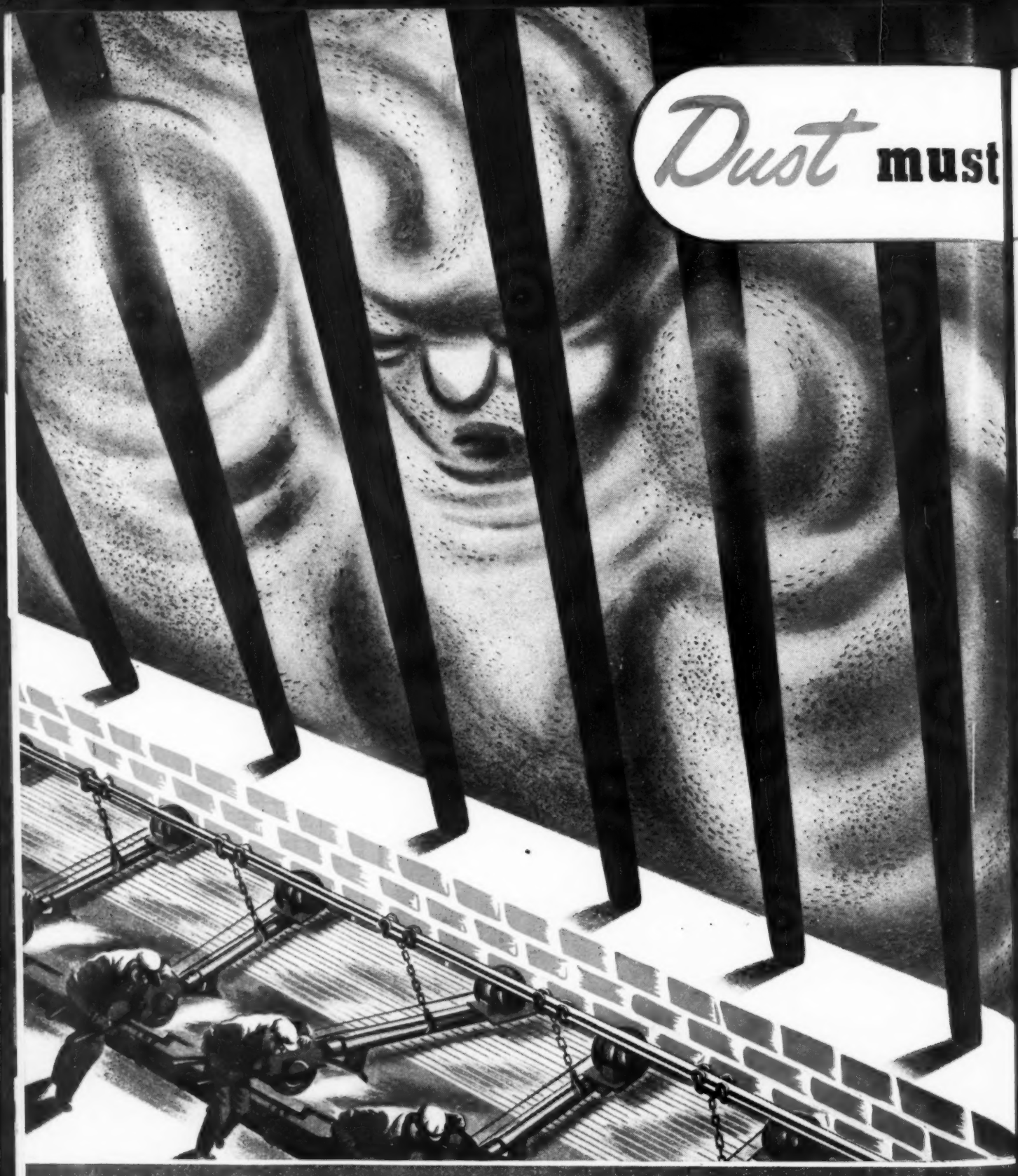
(Title)

(Company)

(Street Address)

(City and State)

A-1582



Sturtevant Systems

REG. U.S PAT. OFF.

AND EQUIPMENT

ENGINEERED FOR PRECISION-VENTILATING, HEATING, AIR CONDITIONING, DRYING, DUST AND FUME CONTROL, PNEUMATIC CONVEYING, MECHANICAL DRAFT

get life imprisonment in 194V

Under the lash of all-out production, Industry has learned many new reasons for keeping a close watch on Dust—and its treacherous ally, Fumes. Utilizing the most advanced development of Sturtevant Air Research and Engineering, industry has been able, through effective air control, to boost output, pare down operating costs, and improve product quality—to a degree never before thought possible.

Take the manufacture of aircraft engines, for example. Destructive dust from buffing and grinding operations must be whisked away as soon as it leaves the wheels. But there's an extra twist that Sturtevant Air Engineering gives this job. Instead of carrying off and wasting the conditioned room air, it's whirled through dust separators, purified and returned to the room with all its valuable heat intact. Savings at the coal pile run as high as $8,000 a year.

In giant booths where motorized equipment is spray painted, you'll find another Sturtevant dividend. Controlling the toxic fumes that spurt from spray guns was not enough. All air entering the room is now purged of dust or anything else that could impinge on freshly painted surfaces. Repainting was minimized and the production line went into high gear.

Processing metals at Victory-speed and efficiency calls for still another touch of Sturtevant genius. Acid fumes, destructive enough to eat through steel beams and keep labor turnover as high as 50% are now precision-controlled. Absenteeism is down to normal, costly equipment safeguarded and production quotas reach a new high.

And there are hundreds of new products, such as the miracle of making artificial wool from cow's milk, born with an inherent fume control problem that Sturtevant had to lick before production could be achieved.

Remember, all these advantages of dust and fume control—that are helping turn out better war goods, faster and more efficiently—will be equally important when industry returns to competing for postwar markets. Without "air at work," no plant can expect to compete on an equal footing.

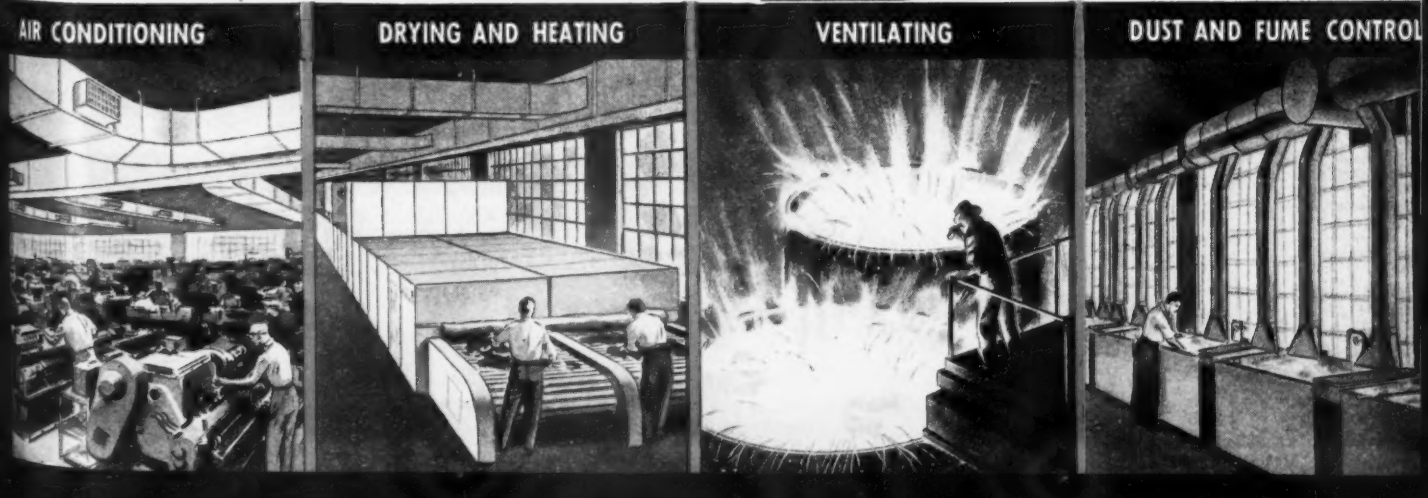
ENGINEERED AIR will make a difference.

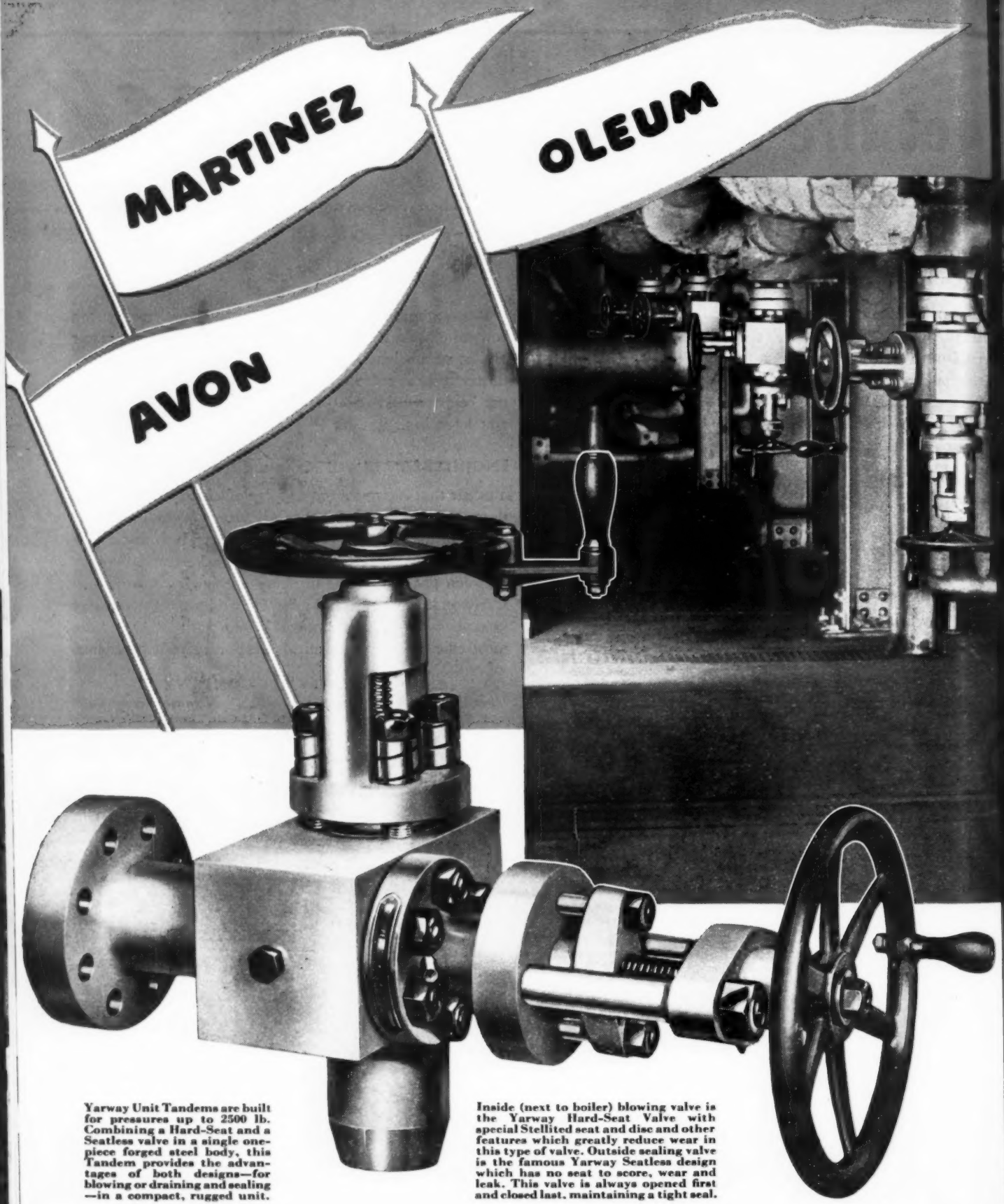
Yes, air that is engineered to serve efficiently—not only in dust and fume control but in all phases of industrial air conditioning, heating, ventilating, drying, pneumatic conveying, and mechanical draft—will make the difference between profit and loss in many a plant. And with new war-won knowledge, backed by experience as the pioneer in air-handling, Sturtevant will be in a position to find the most efficient and economical solution to your problems.

B. F. STURTEVANT COMPANY
Hyde Park, Boston, Mass. *Branches in 40 Cities*
B. F. Sturtevant Company of Canada, Ltd., Galt, Toronto, Montreal

STURTEVANT—FOUNDER OF THE AIR HANDLING INDUSTRY

Sturtevant
REG. U.S. PAT. OFF.
Puts Air to Work



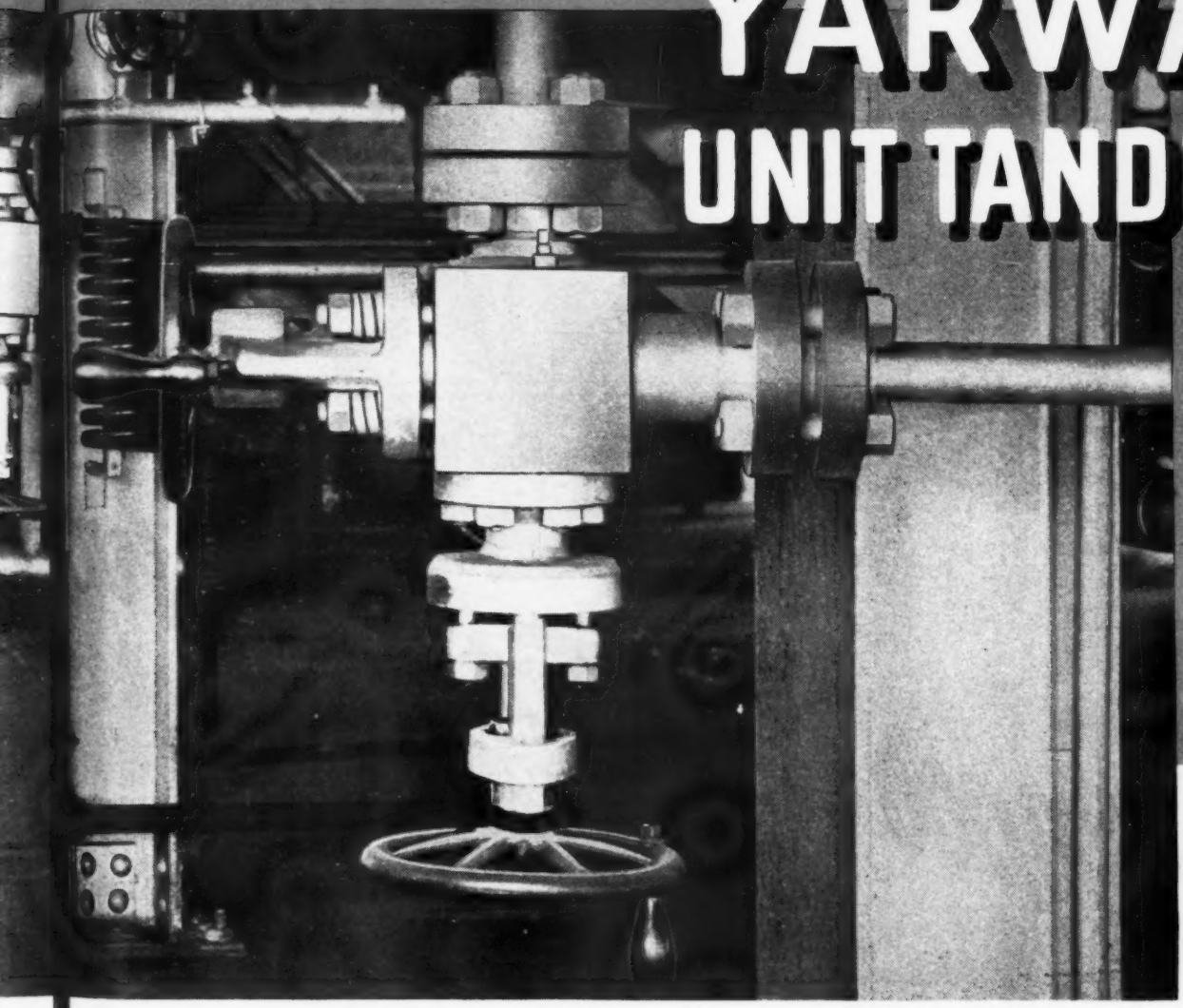


Yarway Unit Tandems are built for pressures up to 2500 lb. Combining a Hard-Seat and a Seatless valve in a single one-piece forged steel body, this Tandem provides the advantages of both designs—for blowing or draining and sealing—in a compact, rugged unit.

Inside (next to boiler) blowing valve is the Yarway Hard-Seat Valve with special Stellited seat and disc and other features which greatly reduce wear in this type of valve. Outside sealing valve is the famous Yarway Seatless design which has no seat to score, wear and leak. This valve is always opened first and closed last, maintaining a tight seal.

YARWAY

All Three of These Pacific Gas & Electric Co. High Pressure Stations Completely Equipped with YARWAY UNIT TANDEMS



THREE more in the long list of modern, high pressure generating stations to select Yarway Unit Tandem Blow-Off Valves — the 1500 lb Martinez, Avon and Oleum Stations of the Pacific Gas and Electric Co.

The illustration shows five of the six Yarway Unit Tandems in use on water wall drains and boiler blow down lines at Martinez Station. All together, there are 24 High Pressure Yarway Unit Tandems in use in the three plants. 80% of the leading high pressure utility and industrial plants have selected Yarway Tandem Blow-Off Valves.

Years of service have proved the sound design and metallurgy of these valves for blowing down or draining and sealing. Such records as—"3000 blows at pressures of more than 1300 psi without a single replacement of parts or repairs of any nature"—have made the Yarway Unit Tandem the outstanding preference for high pressure service today

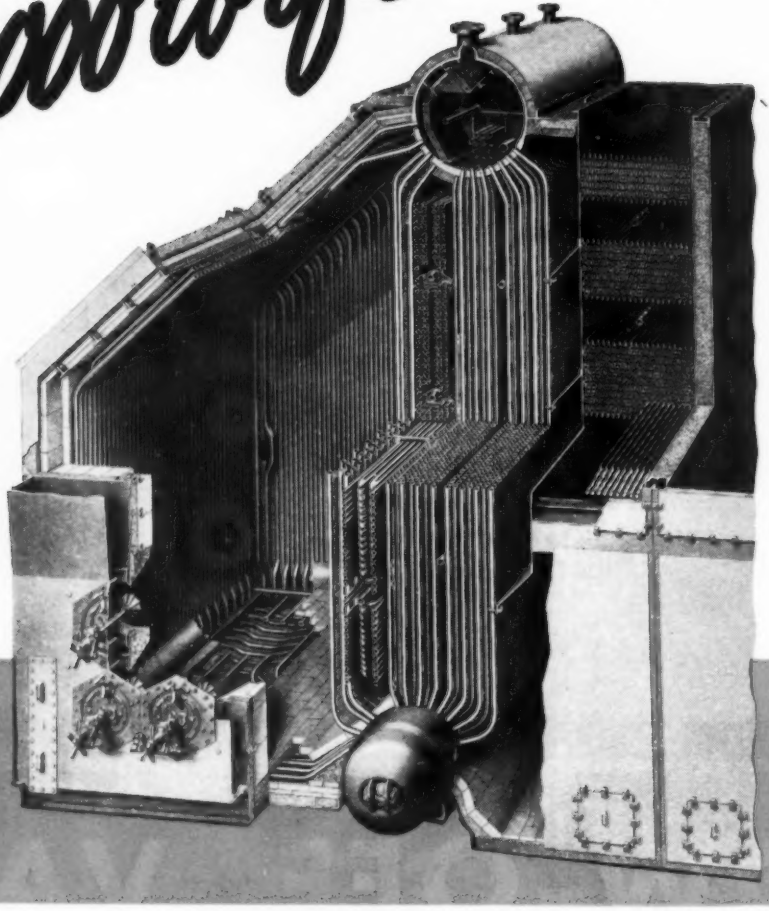
What are your draining and blow down requirements? Write for Catalog. Section B-431 for pressures up to 2500 lb; section B-422 for lower pressures.

YARNALL-WARING COMPANY
100 Mermaid Avenue, Philadelphia, Pa.

BLOW-OFF VALVES

★Stationary design

40,000,000 lb of steam per hr



★Marine design

...supplied by C-E Victory Units

FOR NAVY YARDS ★ MUNITIONS ★ ARSENALS ★ ORDNANCE ★ ARMY & NAVY BASES ★ SYNTHETIC RUBBER ★ HIGH OCTANE GAS ★ MARITIME COMMISSION SHIPS ★ NAVAL VESSELS

All over our country today — actually in 19 different states — and in U. S. Maritime Commission and Naval Ships on every ocean, Combustion Engineering Victory Units are right up there in the front line for victory.

For VU Steam Generator contracts for such vital installations as those listed above now have an aggregate capacity of over 40,000,000 lb of steam per hr. This rate of steam output would be sufficient to serve about 13 per cent of the total fuel-generated kilowatt capacity of all the public utility plants in the country.

And this doesn't include other millions of pounds of steam that give added significance to the name Victory Unit. For in many industrial and utility plants from coast to coast VU Units are supplying the power to produce planes, tanks, food, oil, clothing, guns, instruments, and scores of other war products.

It's logical, too, for the VU Unit to play this important role in war production. In time of peace it had an established reputation for quality, reliability and efficiency, and thus was a natural choice for a war-time job where trouble-free operation and continuous services are primary considerations.

A-732

COMBUSTION ENGINEERING

200 MADISON AVENUE, NEW YORK, N. Y.

By improving equipment, applying new designs, J&L is increasing war-steel production

COPYRIGHT 1943 — JONES & LAUGHLIN STEEL CORPORATION

FROM AN ORIGINAL DRAWING BY ORISON MACPHERSON

MEN OF SCIENCE AND SKILL EXPAND WAR-STEEL PRODUCTION

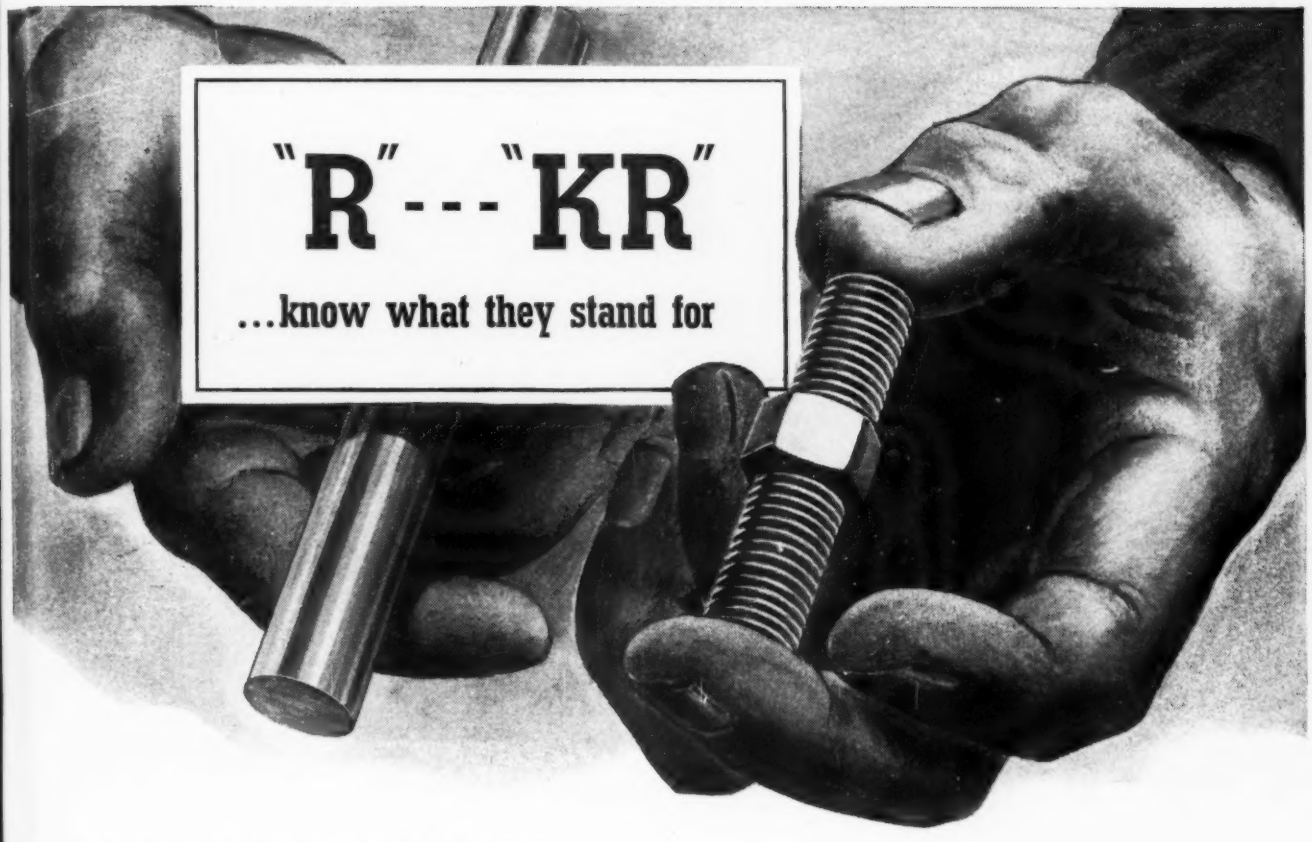
On the steel front the forward lines of production are backed up by the design-engineers and draftsmen, the maintenance men and construction crews. Scores of special engineers, in cooperation with experienced steel men, design new furnaces and develop mill improvements for increasing steel production. They coordinate their plans with the on-rushing future so that at the first opportunity, essential new work can be built with minimum interference to war-steel production. In the constant glare of adjacent furnaces, hundreds of riggers, welders, carpenters, bricklayers, pipe-fitters, electricians, men of a dozen crafts and trades, are working at a fighting pace building new steel-making facilities — rebuilding and improving others. Today, more steel than ever before — 85 million tons a year — is being produced to provide our fighting men with arms and equipment to crush enemy forces and to protect our own.

JONES & LAUGHLIN STEEL CORPORATION

PITTSBURGH, PENNSYLVANIA

CONTROLLED QUALITY STEEL FOR WAR

J&L STEEL



Special Monels with Superior Machining Properties

The strength and corrosion resistance of Monel are so well known that they require no comment.

But do you realize that in addition to *regular* Monel, there are two *special* Monels—"R" Monel and "KR" Monel?

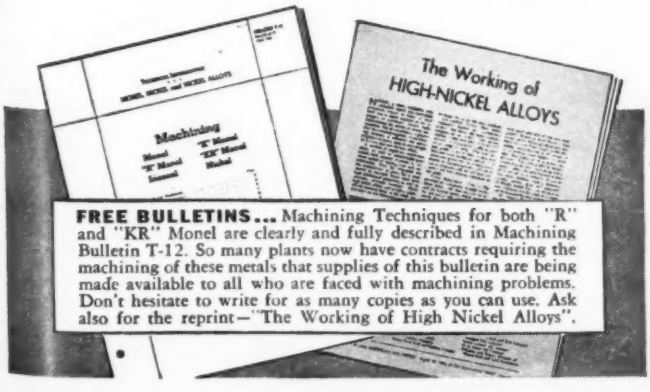
"R" Monel . . . When introduced several years ago, "R" Monel made available the properties of Monel coupled with improved machinability.

"R" Monel is readily fabricated by cold forming—is produced as hot-rolled and cold-drawn rounds, squares and hexagons. It is ideally suited for the automatic production of rust-proof screw machine parts, yet has mechanical properties equal to steel screw stock (S.A.E. 1112), and is actually tougher. "R" Monel is NOT heat-treatable. (See "KR" Monel below.)

"KR" Monel . . . The newest member of the Monel family, "KR" Monel, offers machining qualities you wouldn't expect to find in a metal with so many other superior properties—corrosion resistance combined with non-magnetic characteristics, plus exceptional hardness and strength that can result only from heat treatment.

"KR" should be used for screw machine products which are to be heat treated after machining. Remember "KR" Monel as the MACHINABLE brother of "K" Monel, long known for its great strength and hardness. The International Nickel Company, Inc., 67 Wall Street, New York, N. Y.

★ ***SAVE MACHINING TIME AND MONEY . . . Specify "R" Monel and "KR" Monel***



FREE BULLETINS . . . Machining Techniques for both "R" and "KR" Monel are clearly and fully described in Machining Bulletin T-12. So many plants now have contracts requiring the machining of these metals that supplies of this bulletin are being made available to all who are faced with machining problems. Don't hesitate to write for as many copies as you can use. Ask also for the reprint—"The Working of High Nickel Alloys".

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street, New York, N. Y.

Gentlemen: Please send me copy of your Machining Bulletin T-12 and also the reprint "The Working of High Nickel Alloys."

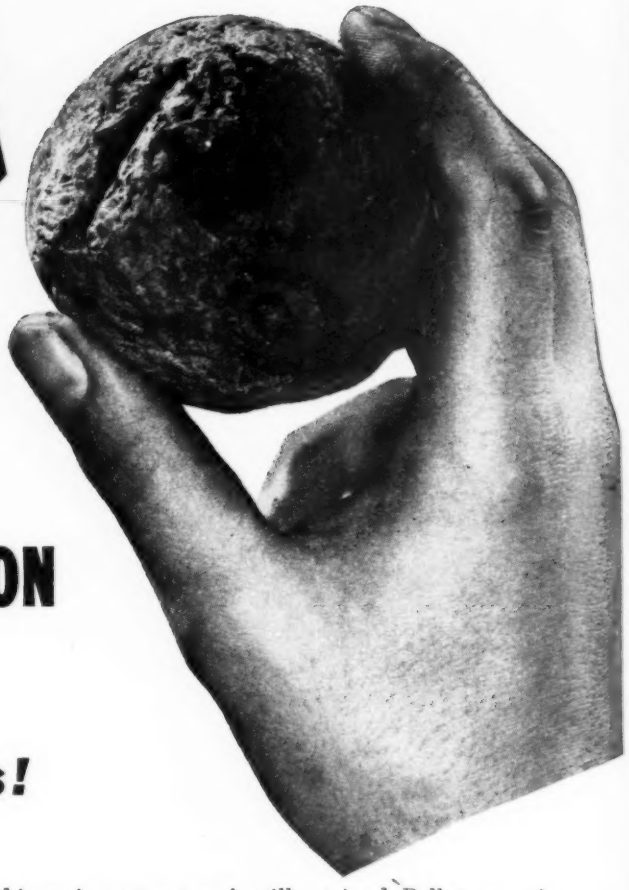
NAME _____

COMPANY _____ TITLE _____

P. 6-43

ADDRESS _____

FACTS YOU MAY NOT KNOW ABOUT EAGLE MINERAL WOOL INSULATION



EAGLE SUPER "66" INSULATION INHIBITS RUST

—*razor blade test shows!*

Bury a shiny new razor blade in a wet ball of Super "66"—Eagle-Picher's outstanding Insulation for temperatures up to 1800° F. Let ball and blade stand several weeks. When removed, notice how free from rust the blade is.

No trick of parlor magic . . . but proof positive that this insulating cement is not merely non-corrosive, but actually helps inhibit rust! And its insulating efficiency is remarkably outstanding.

Springy Ball Structure

Secret of the sensational insulating efficiency of Eagle Super "66" lies in the springy pellets of Eagle Mineral Wool that are its basic ingredient. *After* the insulation is applied, this springy structure is still retained. Pellets contain millions of dead air cells which do not crush down. Full efficiency is maintained—coverage is increased, and shrinkage held to a minimum.

All Purpose—and it's Reclaimable

Eagle Super "66" can be applied to practically all heating equipment. It requires no special tools; exceptional workability means low installation cost. And when used on temperatures up to 1200° F., it may be removed, reworked and reused if desired!

We will send on request full particulars on Eagle-Picher High Temperature Insulations, and show how they will save you money and fuel. Current demand is very heavy, but we are endeavoring to fill all orders without undue delay.

EAGLE-PICHER HIGH TEMPERATURE INSULATIONS

Eagle Super "66" Plastic Insulation
Eagle Supertemp Blocks
Eagle L-T Felts
Eagle Blankets

EAGLE 1843 EP 1943 PICHER

Eagle Finishing Cements
Eagle Loose Wool
Eagle Insulseal
Eagle Insul-stic

THE EAGLE-PICHER LEAD COMPANY, Cincinnati, Ohio

Today's Pioneers Are Planning Committees

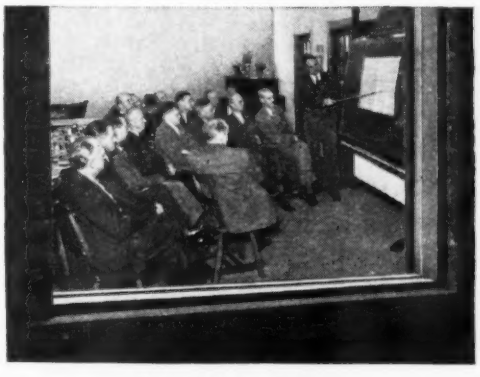
Out of the pioneer meetings came our early progress; out of today's Planning Committees in many organizations and industries will come security and prosperity for a new America.

Every Friday night at 1088 Ivanhoe Road the lights burn late while the Reliance Future Planning Committee is at work. At other times, these Reliance engineers, production and sales men devote their energy to making more war goods, quicker.

But, one night a week in true pioneer spirit, they tackle the problems of electric motors and motor-drive of the future. They start from scratch. They take nothing for granted. They assume there is a better way to build every motor; and that no motor-drive problem is unsolvable.

Their past performance is a guarantee of big things to come. They've licked some pretty tough assignments in many different industries—and even tougher ones for our armed forces. They have "on tap" many important developments in simple, flexible, production-boosting, electric motor-drive and control.

Reliance engineers—pioneers in their field—are available to help *you* with your motor-drive problems.



Friday Night at Reliance

RELIANCE A·C D·C MOTORS

RELIANCE ELECTRIC & ENGINEERING CO.

1088 Ivanhoe Road • Cleveland, Ohio

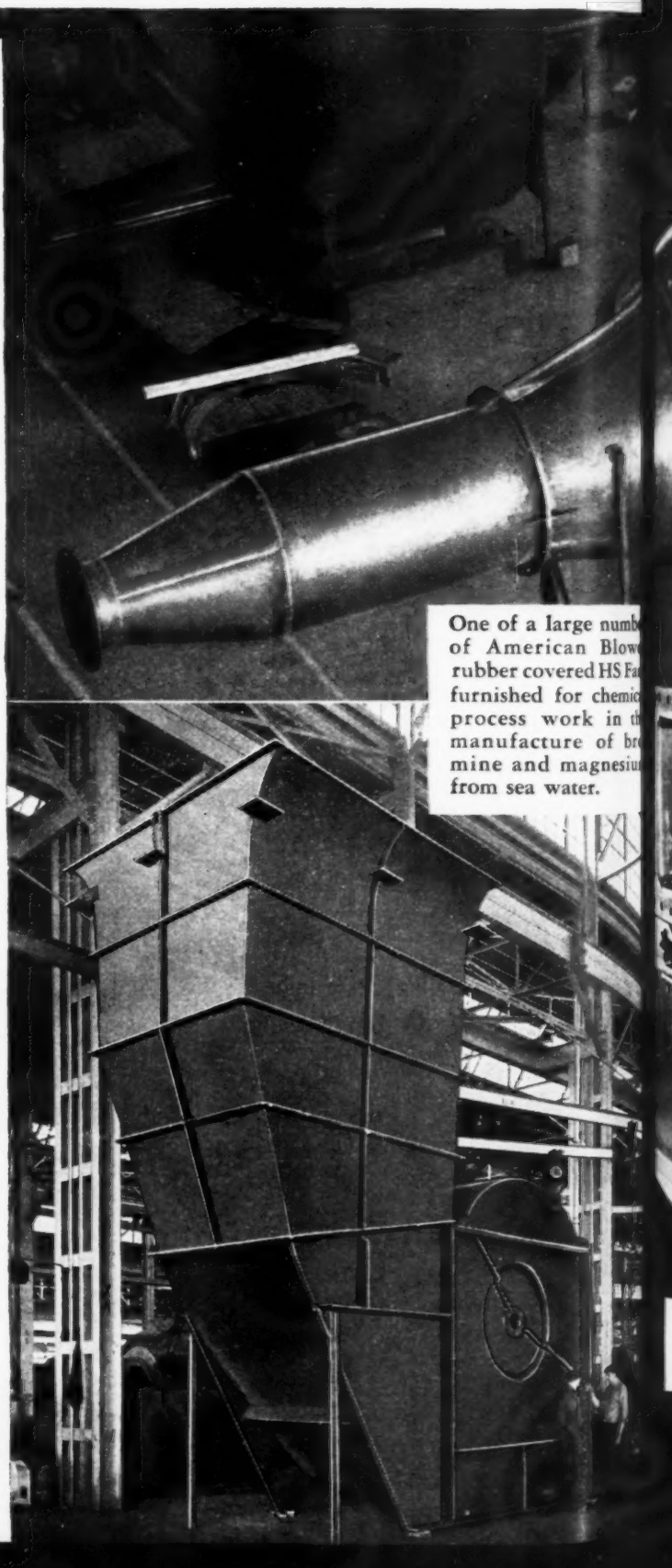
Birmingham • Boston • Buffalo • Chicago • Cincinnati • Detroit • Greenville (S.C.) • Los Angeles • New York Philadelphia • Pittsburgh • Portland (Ore.) • St. Louis • San Francisco (Calif.) • Syracuse (N.Y.) and other principal cities.

Progress and Power in the CHEMICAL INDUSTRY!

THE chemical industry is not only playing a vital part in winning the war, but all indications are that it will play an important role in determining the progress and prosperity which we all believe will follow the peace.

American Blower, too, serves the chemical industry both directly and indirectly. For years, American Blower Mechanical Draft Fans, Dust Collectors and other air handling equipment and Fluid Drives have been extensively used in America's great public utilities to furnish power for the manufacture of chemicals. American Blower engineers have worked directly with the chemical industry in furnishing Centrifugal Collectors used in collecting valuable materials in process work, in furnishing acid resisting fans and blowers, and other equipment for moving air and gases.

The dependable performance of American Blower equipment in these great vital industries today will, we believe, warrant an even wider use of American Blower products in the carefully planned post-war progress of both the chemical and public utilities industries.

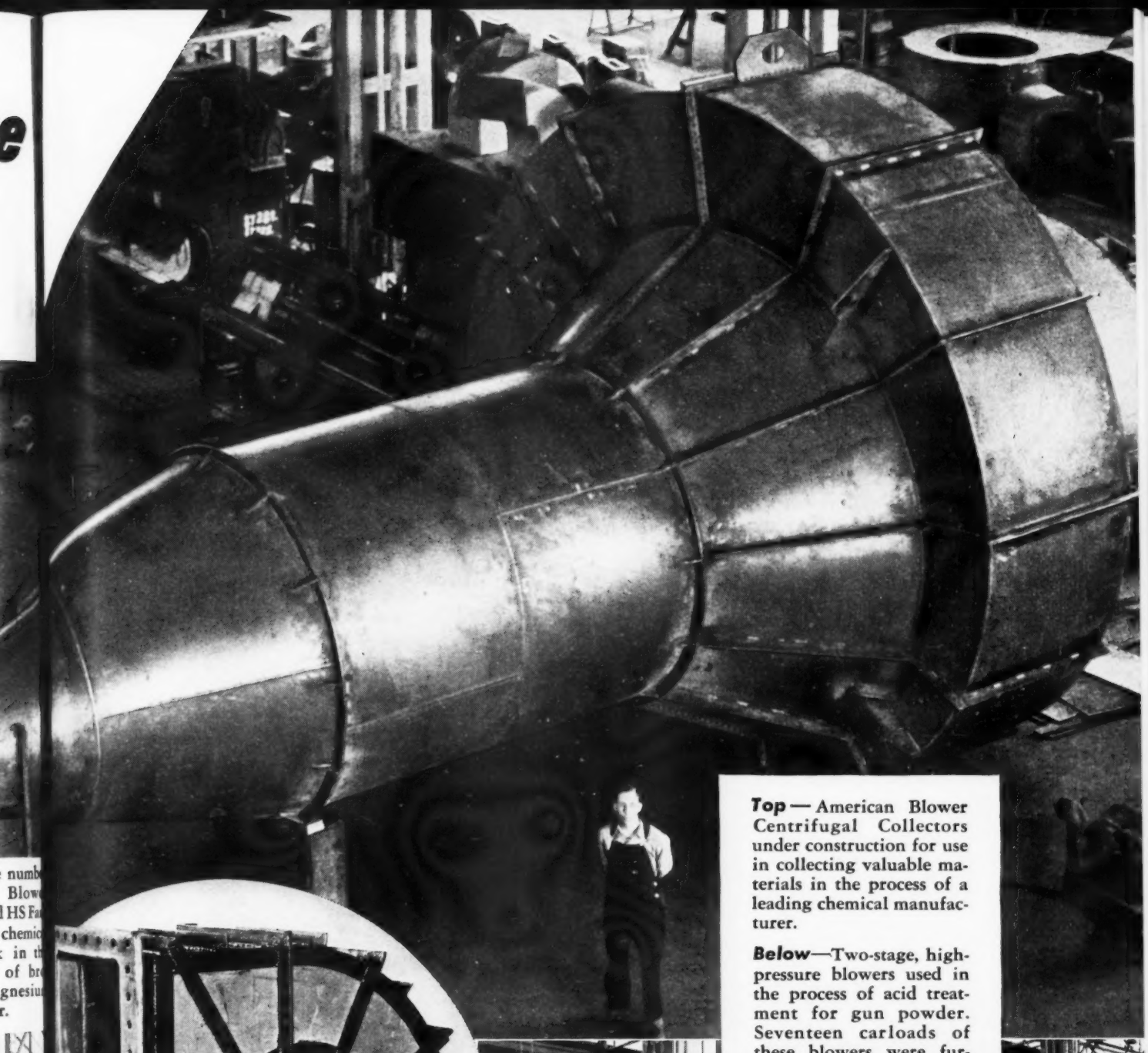


One of a large numb of American Blow rubber covered HS Fa furnished for chemic process work in th manufacture of br mine and magnesiu from sea water.

AMERICAN BLOWER

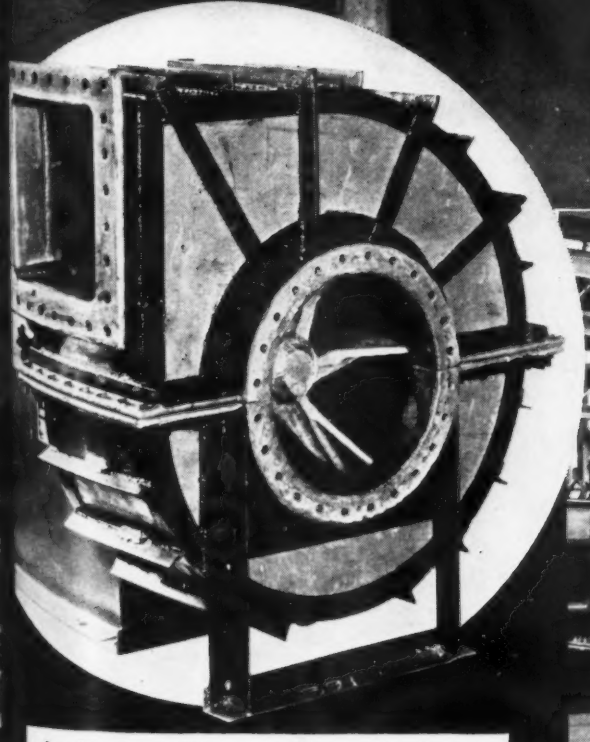
AMERICAN BLOWER CORPORATION, DETROIT, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO
Division of AMERICAN Radiator and Standard Sanitary Corporation

The Army-Navy "E" Flies Over All American Blower Plants.

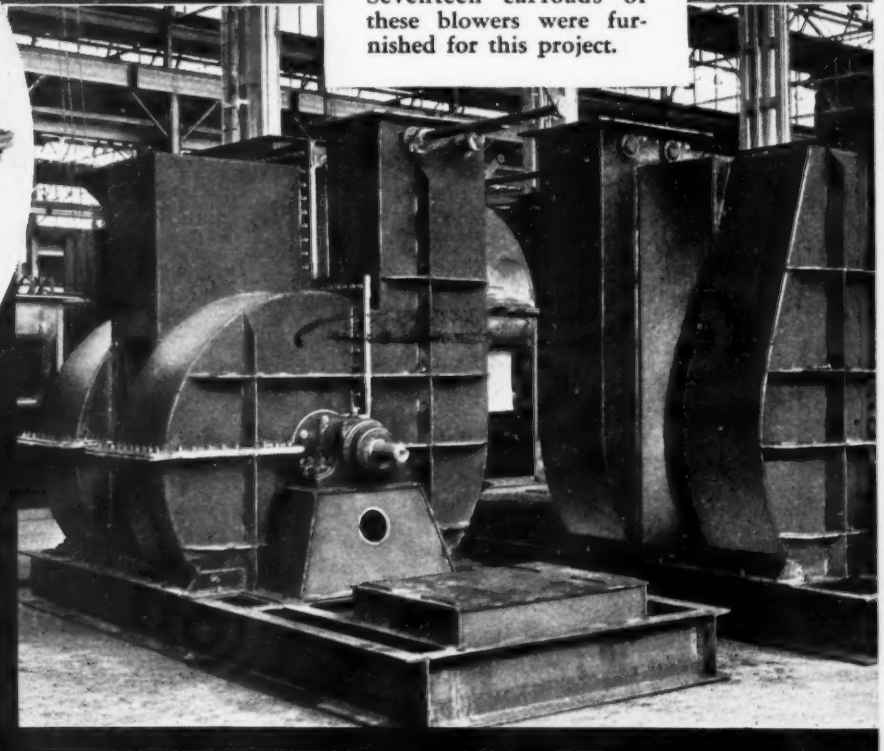


Top — American Blower Centrifugal Collectors under construction for use in collecting valuable materials in the process of a leading chemical manufacturer.

Below—Two-stage, high-pressure blowers used in the process of acid treatment for gun powder. Seventeen carloads of these blowers were furnished for this project.



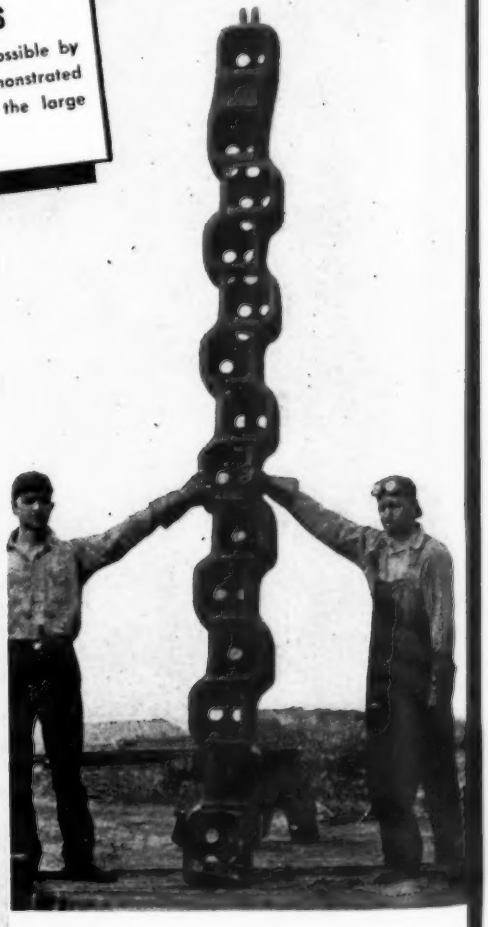
An American Blower lead coated exhauster for handling warm acid laden gases in a chemical plant.



Design FLEXIBILITY

TYPICAL HEADER DESIGNS

The wide variety of header designs made possible by the use of cast electric steel is visually demonstrated in the accompanying photos of a few of the large types of Springfield headers.



SPRINGFIELD BOILERS

SPRINGFIELD

MODERN STEAM GENERATING UNITS

Extra RELIABILITY

. . WITH SPRINGFIELD BOILER HEADERS OF CAST ELECTRIC FURNACE STEEL . .

CAST STEEL MEETS ALL REQUIREMENTS

Springfield header steel is produced by the Electric Furnace process with accurate control of chemical analysis. Foundry practices based on over 25 years' experience assures sound castings — — fully annealed before leaving the foundry. Steel in the finished header is ductile as illustrated by the twisted and bent specimens and a 30" long turning produced in boring the header. Analysis and physical properties will comply with all construction Code requirements. Carbon steel, used for most Springfield headers under 600 lbs. working pressure, tests 72,000 lbs. per sq. in. minimum tensile strength. For higher working pressures, strength is increased by use of alloy steel and ranges from 85,000 to 105,000 lbs. per sq. in. tensile strength.

THE development of the use of cast steel for boiler, water wall, superheater and economizer headers is just one of the factors which have established a reputation for Springfield as a builder of more reliable, longer lasting boiler units, and the design flexibility of this construction is the principal reason why Springfield Sectional Water Tube Boilers have a much broader field of application than other sectional header designs.

Springfield boiler headers, proven in service for more than thirty years, have demonstrated fully the following advantages of cast steel construction:

DESIGN FLEXIBILITY

1. Casting process is adaptable to a wide variety of header designs so that headers can be made the desired and proper size and shape to give best results for each particular application.

2. Uniform strength is assured throughout entire header structure by increasing the casting thickness or incorporating reinforcing ribs as required.

3. Unusual flexibility in design is possible at nominal cost by modifying patterns to meet required conditions.

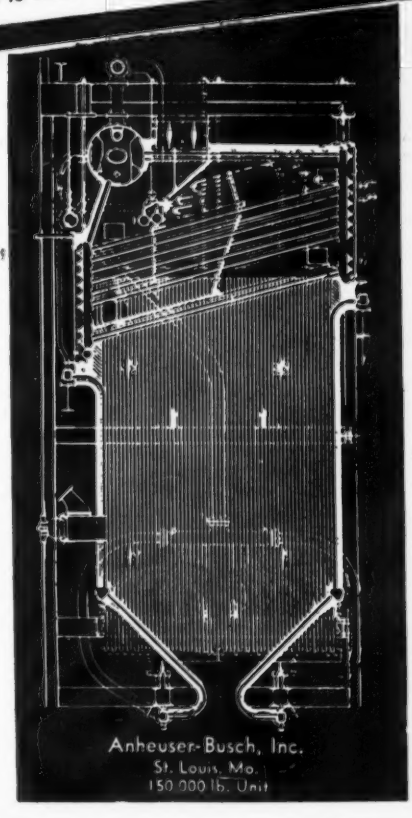
EXTRA RELIABILITY

1. A tougher metal because, while the finished metal is ductile, it does not have to be as soft as the steel used in headers which are forged or pressed to shape. This means stronger sections, tube holes which will resist tube rolling and form tighter, stronger rolled connections.

2. A stronger metal with yield point and tensile strength 25% greater than in the usual forged or wrought steel.

3. Longer life as no seams or crevices are present to form starting points for embrittlement or corrosion and the cast surfaces are, by nature, corrosion resistant. Pitting or corrosion has never been reported in Springfield headers.

Write to Springfield today for complete data on boilers to meet your requirements. SPRINGFIELD BOILER COMPANY, 1953 E. Capitol Avenue, Springfield, Illinois.



Anheuser-Busch, Inc.
St. Louis, Mo.
150,000 lb. Unit

BOILER CO.

ANY SIZE • ANY FUEL • ANY PRESSURE

The TERRY

GRABBING A 1

This 1500 KW Terry unit is equipped with the Terry solid one piece wheel. The buckets, as shown above, are milled from the solid metal. There are no parts to work loose. • • • The blades have large clearances and are further protected by the projecting rims at the sides of the wheel. These rims would take without damage any rubbing that might occur if the radial clearance became reduced. • • • End play can do no damage to the blading as the side clearance is very large (about one inch). There is no end thrust since the steam enters and leaves the wheel in a direction at right angles to the shaft. • • • Such sturdy rotor construction makes for long life and low maintenance.

The quick starting Terry turb alternator unit, shown at th right, is installed in a recent completed West Coast centr station. Normally, the station au iliaries are supplied with electri power from a house service tran former. During periods of lo system frequency or in case failure of the house service, th auxiliary load is taken over b the Terry unit.

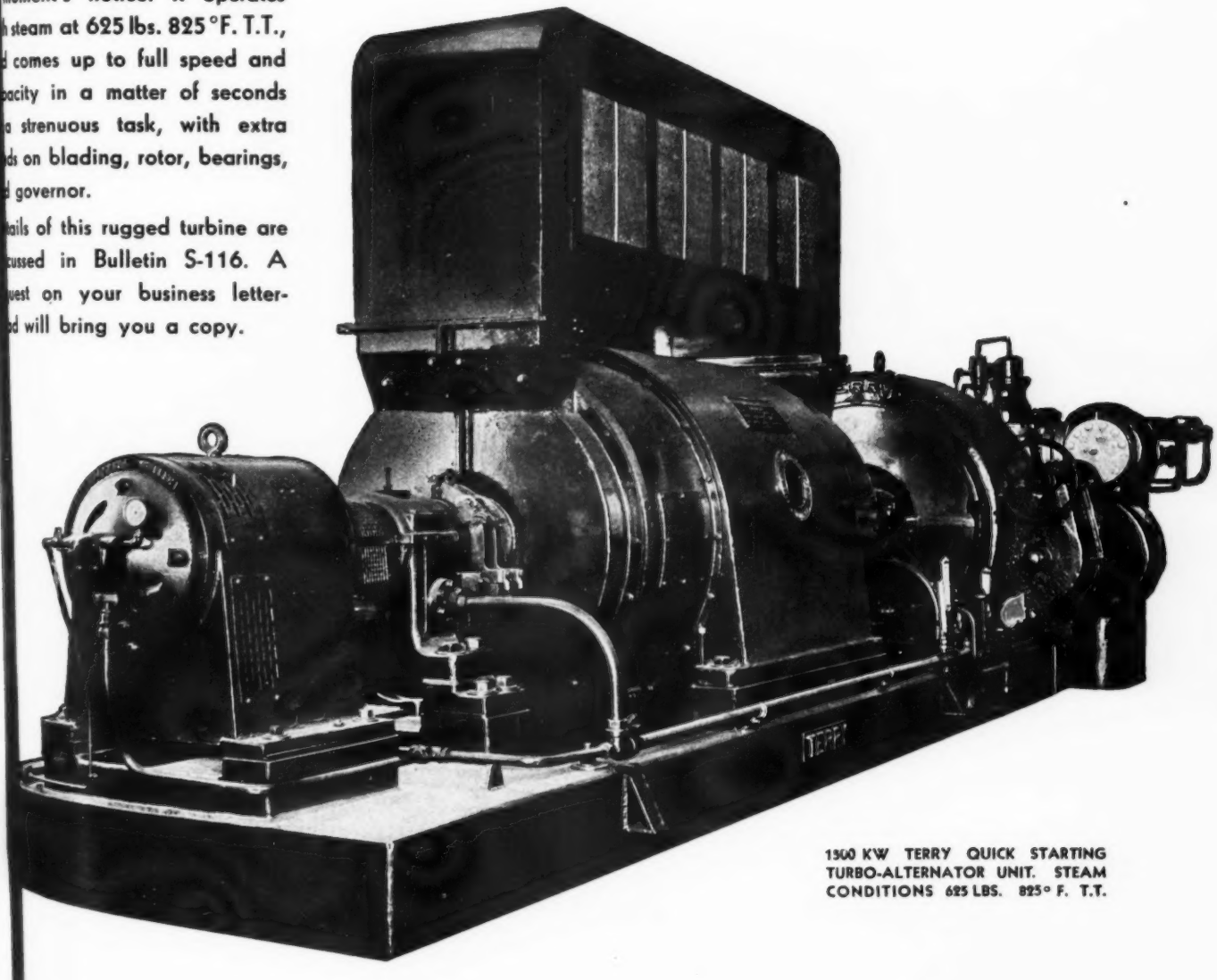
THE TERRY STEAM TURBINE CO.

Wheel Turbine

A 1500 KW LOAD ON A MOMENT'S NOTICE!

turbo unit is ready to take over on at th moment's notice. It operates recenti h steam at 625 lbs. 825°F. T.T., centra d comes up to full speed and ion au acity in a matter of seconds electri a strenuous task, with extra ce tran ds on blading, rotor, bearings, of lo d governor.

case d ails of this rugged turbine are ice, th cussed in Bulletin S-116. A over b uest on your business letter- d will bring you a copy.



1500 KW TERRY QUICK STARTING TURBO-ALTERNATOR UNIT. STEAM CONDITIONS 625 LBS. 825° F. T.T.

T-1150

TERRY SQUARE - HARTFORD, CONN.

THE MAGNAFLUX CORPORATION ANNOUNCES A

new service

● The power field has known Magnaflux Corporation as the *company* behind a *method.* Now it is time to enlarge that idea. The Magnaflux Corporation, originator of three inspection methods, and manufacturer of equipment, is also a service organization.

The method of magnetic indications (Magnaflux) was readily accepted from the start as having strong possibilities in equipment overhaul inspection. Among operators who investigated those possibilities, striking results were achieved. Prevention of shutdowns plus prolonged periods of service and reduced costs created a desire for regular consistent service—MAGNAFLUX POWER PLANT INSPECTION SERVICE.

In announcing this Magnaflux Service it is remarkable that two additional methods which greatly increase its scope are now fully developed and included—teamed up with the Magnaflux Method for all 'round flaw detection! Prospective savings to Industry run far into the millions.

The Basic Technique: Magnaflux

The basis of the Magnaflux Method is to set up a magnetic field in parts under inspection. Leakage fields attract and hold finely divided ferro-magnetic particles in patterns which locate discontinuities. Naturally this was restricted to magnetic metals. Even so, the time saved in shortening overhaul periods was a big economy. A Magnaflux turbine inspection engineer inspects about 20,000 KVA of blading per day in assembled spindles (under normal conditions). Only the upper half of the housing need be removed. Cracked blading, incipient cracking in turbine discs, both radial and the circumferential type which occurs between balance holes, can be found. Inspection of a turbine requires less than one-third of the time of visual and magnifying glass methods, and is infinitely superior in accuracy.

Magnaflux, Plus Magnaglo

To this service, there is now added, through development by Magnaflux Corporation's research staff, all the possibilities of the Magnaglo Method. For surfaces on which the ferro-magnetic indication cannot be clearly observed, either through texture, color or lack of light, Magnaglo provides a speedier more sensitive method. It yields the same type of indications seen in correctly magnetized parts of steel and its magnetic alloys. The same distribution of ferro-magnetic particles is made—with this refinement: *The particles are also fluorescent and glow brilliantly in darkness under black light.*

Plus Zyglo for "Non-Magnetics"

It is only a step from this development to the most amazing increase in the scope of Magnaflux Service. The Zyglo method permits *similar inspections of the non-magnetic metals.* The complete service job now opens up the great majority of all plant equipment to the economy, safety and conservation of *preventive inspection.* Aluminum, brass, stainless steel and bronze practically double previous possibilities.

Zyglo, by successive applications of a penetrant fluroscent liquid, a rinse, and a developing powder, reveals discontinuities which can be clearly interpreted under black light in darkness.

Three Methods Combined

A three-way advance in technique therefore enables Magnaflux Corporation to offer a fully rounded service for the power field. On notification of an expected overhaul a service engineer's time can be scheduled for a plant, and a more thorough check than ever was possible before can be made of all primary equipment for indications of fatigue, embrittlement, distortion. Like specialized

Detection at These Typical Failure Points

- Fatigue Cracks
  - in Turbine Blading
  - in Engine Shafts
  - in Turbine Disc Wheels
  - in Crank Webs
- Progressive Fractures
- Lap Seam Cracks
- Caustic Embrittlement in Boiler Plate
- Cracked Frames
- Vibration Effects on Piping Threads
- Inter-granular Cracking of Boiler Drums
- Flywheel Spoke Fractures
- Overheated Boiler Shells
- Defective Welds
- Overstressed Pipe Bends
- Overstressed Chains, Grapples and Chains and Crane Hooks
- Valve Body Failure from Piping Expansion
- Turbine Blade Damage from Adjacent Breaks

MAGNAFLUX CORPORATION

MAGNAFLUX CORPORATION

To Foresee and Prevent Mechanical Failure In Power Plant Equipment

tools, each of the Magnaflux Corporation's techniques can be used where it is most suitable.

Service Organization

Through Magnaflux Corporation's branches and field representatives, a service contract can be made for periodic inspections at a rate based on horsepower and types of equipment. Scheduling of service to coincide with tear-down and overhaul work can be arranged. This division of the Magnaflux Corporation is organized to make a limited number of such contracts at once. Further expansion of the service will follow as the manpower situation permits.

A Limited Number of Plants Can Be Served As An Initial Group.

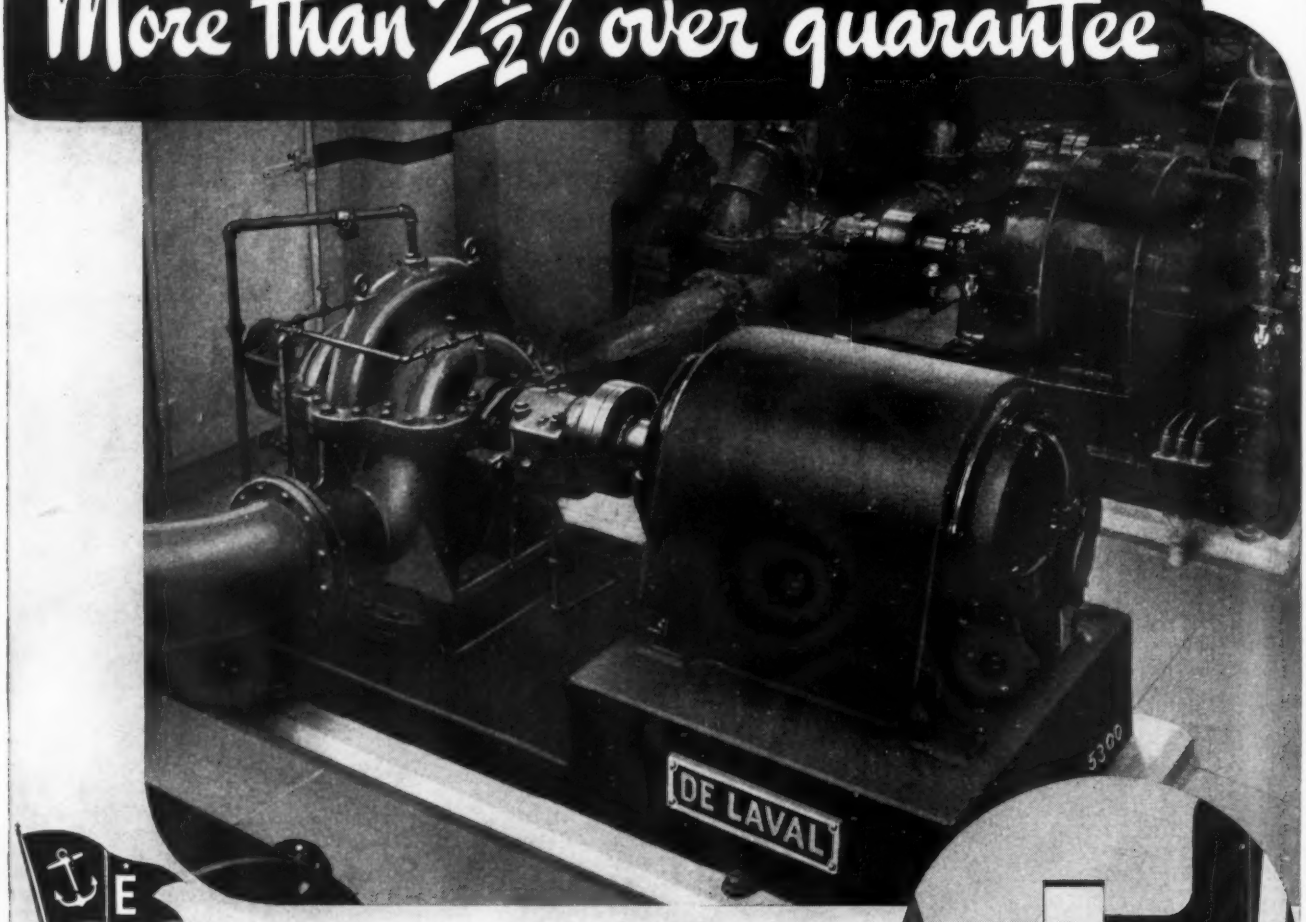
•

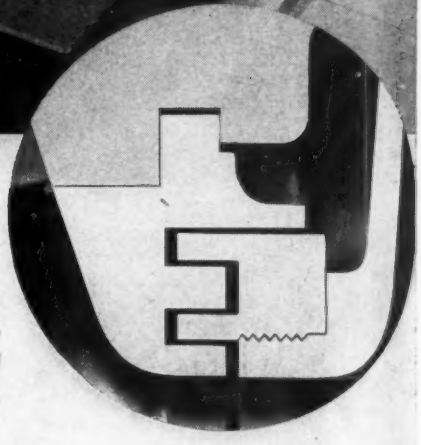
Write for Complete Details

All interested companies are urged to write for the fullest details of the service now. Its benefits will be extended in their territory as rapidly as possible, after a picture of the demand is secured.

5920 Northwest Highway, CHICAGO • New York • Detroit • Los Angeles • Dallas

More than 2½% over guarantee





Cross section of De Laval double labyrinth wearing rings; one ring is held by the casing, while the other is screwed onto the impeller.

***The* DE LAVAL MOTOR DRIVEN PUMP** in the foreground was supplied to a Canadian public utility under a guarantee to deliver 4000 Imperial gallons per minute against a total head of 217 ft. with a wire-to-water efficiency of 78 per cent.

In the official acceptance test by the customer's consulting engineer, this was exceeded by more than 2½ per cent.

The Utility has now ordered for standby service a similar De Laval pump of 5000 Imperial gallons capacity against the same head and driven by a gasoline engine.

The sustained high efficiency of De Laval pumps is made possible by correct hydraulic design and, in large part, by the DE LAVAL LABYRINTH WEARING RINGS, without resort to the close clearances necessary with flat rings. These, and other parts subject to wear, are easily renewable, as they are made to limit gages to be interchangeable.

2538

DE LAVAL *Steam Turbine Co.*
TRENTON, N. J.

MANUFACTURERS OF TURBINES . . . STEAM, HYDRAULIC; PUMPS . . . CENTRIFUGAL, CLOGLESS, ROTARY DISPLACEMENT, MOTOR-MOUNTED, MIXED-FLOW, PROPELLER; PRIMING SYSTEMS; CENTRIFUGAL BLOWERS and COMPRESSORS; GEARS . . . WORM, HELICAL and FLEXIBLE COUPLINGS

POWER

JUNE 1943

VOLUME 87
NUMBER 6

N O WYNKOOP, *Publisher*

PHILIP W SWAIN, *Editor*

Associate Editors: F A ANNETT
S A TUCKER L N ROWLEY JR

Assistant Editors:
E W FELLER G A KEATES

Paul Wooton, *Washington*
G C Tenney, *San Francisco*
H S Knowlton, *Boston*

Business Manager: E J TANGERMAN

STEAM GENERATION, FUELS
TURBINES, ENGINES, AUXILIARIES
HYDROELECTRIC POWER
DIESEL AND GAS ENGINES
PUMPS AND COMPRESSORS
PIPING, VALVES AND FITTINGS
AIR CONDITIONING, REFRIGERATION
ELECTRICAL EQUIPMENT, ELEVATORS
INSTRUMENTS AND CONTROLS
STEAM SERVICES AND HEATING
TRANSMISSION, LUBRICATION
OPERATION AND MAINTENANCE
POWER MISCELLANY

Half billion gpd of water from Toledo's pumps 64
Softener works better with recirculated sludge 67
Build turbine spindle faster by welding 68
Refrigeration facts for apprentice engineers 70
Copper-oxide rectifier—jack of many trades 72
Ready reminders for stoker operators 73
Will colloidal fuel ease oil shortage? 74
Plan air-compressor installations completely 76
The Old Chief was unblessed by instruments 78
DIESEL- AND GAS-ENGINE MAINTENANCE 79
Operation 80
Maintenance 84
Repairs 92
Wartime Power Clinic—emergency repairs 95
New power from airplane engines on test block 99
Removing gas and oil vapors from fuel drums 101
Working around elevators? Don't take chances 102

THE OPERATING ENGINEER

Doing all you can on the feedwater problem? 103
Practical Aids .... 106 Readers' Problems 110
Questions, Answers .... 114 Refrigeration, 3 118
How to weld pipe .... 120 Engineers' Books 124

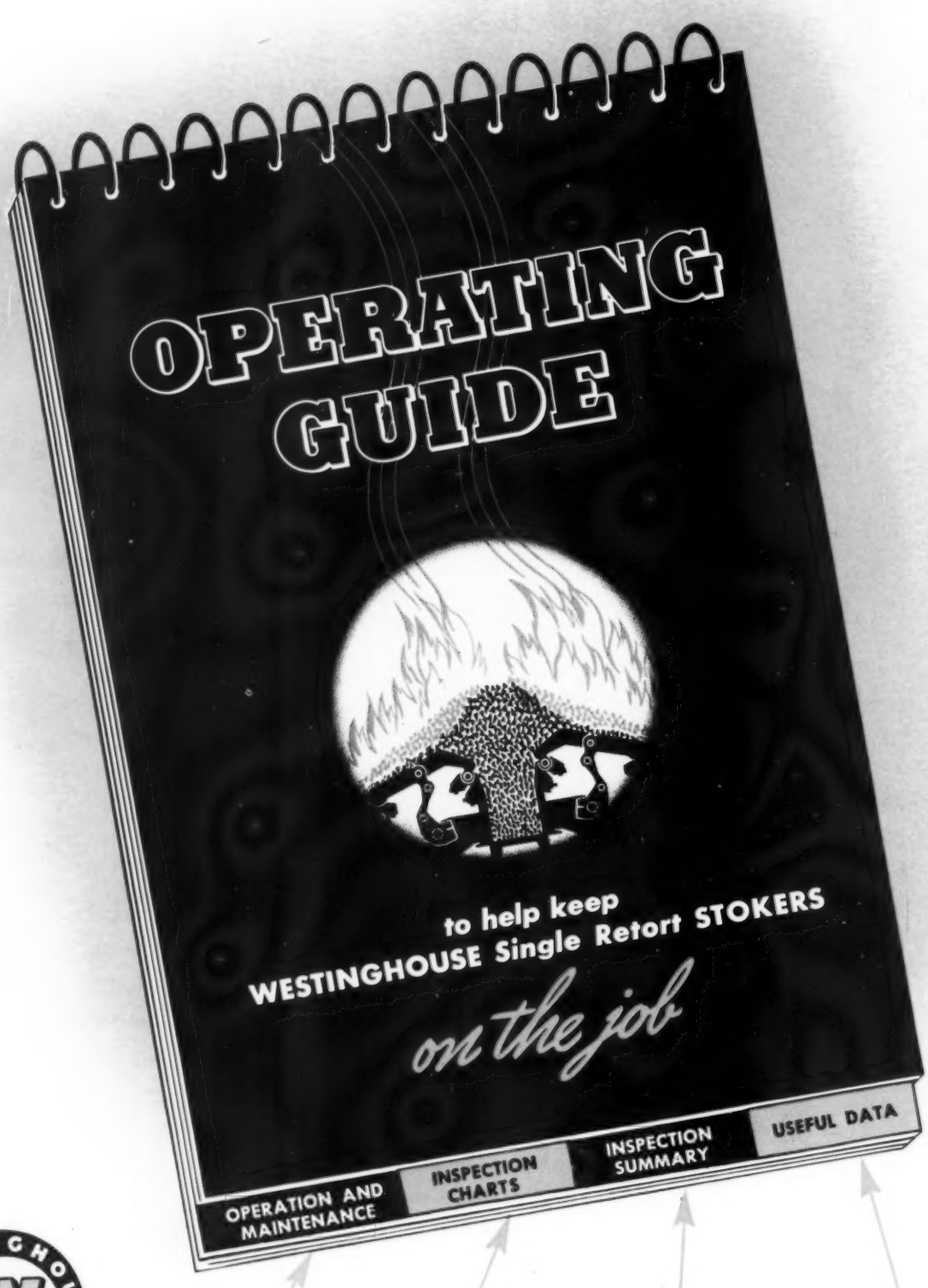
OTHER DEPARTMENTS

New Equipment .... 126 George Edwards 128
Power Lines .... 130 Data Sheet 134

VOLUME 87, NUMBER 6 • A McGRAW-HILL PUBLICATION • **COPYRIGHT 1943, By McGRAW-HILL PUBLISHING CO, INC**

James H McGraw, Founder and Honorary Chairman; James H McGraw Jr, President; Howard Ehrlich, Executive Vice-President; Mason Britton, Vice-President; B R Putnam, Treasurer; J A Gerardi, Secretary; J E Blackburn Jr, Director of Circulation • District Managers: New York, S H Quarles; Philadelphia, C R Long; Cleveland, F B Godley; Chicago, C Boughton; Boston, C L Morton; St. Louis, G G Sears • Editorial and Executive Office: 330 West 42nd St, New York, N Y • Publication Office: 99-129 North Broadway, Albany, N Y • Cable Address: "McGrawhill, New York" • District Offices: Chicago, 520 North Michigan Ave; San Francisco, 68 Post St; Washington, National Press Bldg; Philadelphia, 16 South Broad St; Cleveland, 1510 Hanna Bldg; Detroit, 2-144 General Motors Bldg; St Louis, 1066 Paul Brown Bldg; Boston, 1427 Statler Bldg; Atlanta, 1011 Rhodes-Haverty Bldg; London, Aldwych House, Aldwych, London WC2 • POWER articles are indexed in both the Industrial Arts and the Engineering Index, at public libraries

A WARTIME PLAN.



OPERATING AND MAINTENANCE SUGGESTIONS—brief facts that will help you get more service from your stoker and more heat from your fuel.

INSPECTION CHARTS—detail drawings covering all parts of the equipment and pointing out the operation and maintenance requirements of each.

INSPECTION SUMMARY—an easy way to record your check on stoker equipment and operation, to insure peak performance.

USEFUL DATA—charts for determining heat added per pound of steam, evaporation efficiency, and fuel cost.

to Keep Stokers Operating Efficiently

Here's practical help to keep Westinghouse Single-Retort Stokers in top operating condition. It's a complete, down-to-earth maintenance program—including the kind of information you need to give stokers special wartime care.

You'll find brief facts to help get more service from your stoker, and more heat from your fuel.

You'll find inspection hints covering various parts of the equipment, and suggestions for easy-to-use inspection reports.

Put this plan to work in your plant *now*—to assure top stoker performance, continued production, and low-cost operation. Just follow the four steps listed below.

1 **SEND FOR OPERATING GUIDE AND CHECK CHART**—which give basic operating and maintenance information on Westinghouse single-retort stokers.

2 **TELL YOUR MAINTENANCE MEN** about the importance of this program, and outline the plan.

3 **SET UP REGULAR INSPECTION PERIODS**—covering all points included in Operating Guide and Check Chart.

4 **SET UP INSPECTION RECORD SYSTEM**—using the inspection summary suggested in the Operating Guide.

J-50430

TO START THIS PLAN—JUST CLIP AND MAIL COUPON

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

STOKERS

Westinghouse Elec. & Mfg. Co.,
Dept. 7-N, East Pittsburgh, Pa.

Send to me:

_____Copies Operating Guide, 48-page pocket-size manual, B-3257.

_____Copies Maintenance Check Chart, 16½" x 21½", DC-237.

Company _____

Attention _____

Address _____

City _____ State _____

The completion of this Sperry Gyroscope Company building adds another to the long list of important "war jobs" where Radiant Heating —and Byers Wrought Iron—are serving.

The system was engineered by Stone and Webster, and Alvord and Swift were the heating contractors. It was the first Radiant Heating installation for each concern. All coils were formed with a bending machine on the job, and field-welded into four unit assemblies, each individually controlled by Johnson Service Company thermostats. In situations where additional heating effect was needed in a given area, vertical panels (as shown in small illustration) were installed. The completed piping system was tested at 100-lbs. pressure for four hours, and in 19,000 feet of pipe only three minor leaks were revealed.

The coils were topped with 6-inches of concrete, poured while the coils were filled with water at 100°F. Finished floor will be bare, or linoleum covered. The heating medium is hot water at 110°F., provided by a heat exchanger and zone circulated by four Ingersoll-Rand fractional horsepower pumps.

The influence of proper heating upon production gives extra reason for checking Radiant Heating's advantages against the heating needs of any structure built today. It generally saves considerable metal, leaves all floor-space clear, and introduces no explosion hazards in dangerous operations. Byers Wrought Iron for the coils "permanizes" these advantages; its superior corrosion resistance has been demonstrated in hundreds of applications where service conditions were similar. Its thermal properties are excellent; and it can be readily formed and welded.

Our Engineering Service Department will be glad to discuss any specific design problems with you. We will also be glad to send you a very complete discussion of the entire subject: our technical bulletin, "Byers Wrought Iron for Radiant Heating Installations." Just write.

A. M. Byers Company. Established 1864. Offices in Pittsburgh, Boston, New York, Philadelphia, Washington, Chicago, St. Louis, Houston, Seattle, San Francisco.

19,000 Dependable Feet of RADIANT HEATING Coils

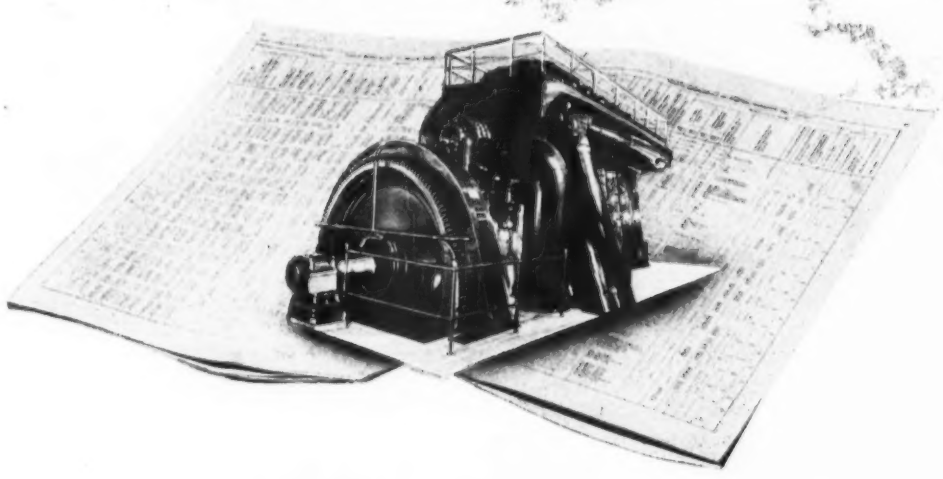
BYERS WROUGHT IRON

Sperry Gyroscope Co., Inc.
Personnel Building
Stone & Webster Engineering Corp.
Architects and Engineers
Alvord & Swift
Heating Contractors

CORROSION COSTS YOU MORE THAN WROUGHT IRON

BYERS
GENUINE WROUGHT IRON
TUBULAR AND HOT ROLLED PRODUCTS
ELECTRIC FURNACE ALLOY STEELS • OPEN HEARTH ALLOY STEELS
CARBON STEEL TUBULAR PRODUCTS

ESTABLISHED IN 1882 **POWER** PHILIP W SWAIN, EDITOR



DEPENDABLE DIESEL COSTS

THOUSANDS OF PROSPECTIVE POST-WAR buyers would like to know what it costs to run a diesel plant. The dependable answer, for 150 American plants, is to be found in the "Report on Oil Engine Power Cost," an official publication of the American Society of Mechanical Engineers.

Issued for each year from 1929 to 1941, inclusive, and sponsored by the ASME Oil and Gas Power Division, this Report has won well deserved acceptance by its thoroughness and impartiality. Cost and performance data straight from the operator, and presented without bias or sales talk, have cleared away the mists of claim and counterclaim that befogged the diesel arguments of the twenties.

The latest report tabulates current performance for all of the 150 plants and lists past performance as well wherever the information is available from previous reports. It divides operating costs into fuel, lubrication, attendance and supervision, supplies and repairs.

These results are given practical meaning by ample background information: installed capacity, number of engines, detailed description of each unit and of its fuel and lubrication, type of plant load, gross and net energy output, load factor, running plant capacity factor, plant service factor, etc.

Fuel prices, wage rates, plant loadings and other conditions may vary appreciably from year to year. Post-war power planners will therefore note with interest that the Report covers at least five years for a majority of the plants and ten years or more for many.

Like most things worth while, this Report is a cooperative venture. At the top is the excellent planning and the hard work of the Oil and Gas Power Division subcommittee headed by H C Major, Commissioner of Utilities, Rockville Centre, N. Y. This committee gathers and compiles the data and prepares the tables and charts. Equally essential is the job done by the many individual engineers who send in their plant facts for the benefit of all.

At this very moment the Report for 1942 is in the making. The questionnaires are out; the quality and quantity of the returns will determine the value of the resulting summary to diesel operators everywhere.

Everybody concerned should pitch in and help. If you received a questionnaire, lend a hand to this ASME undertaking by returning it promptly. If you have diesels, but no questionnaire, ask Harry Major to send you the sheet. Let's all help to make this the biggest and best diesel Report ever published!

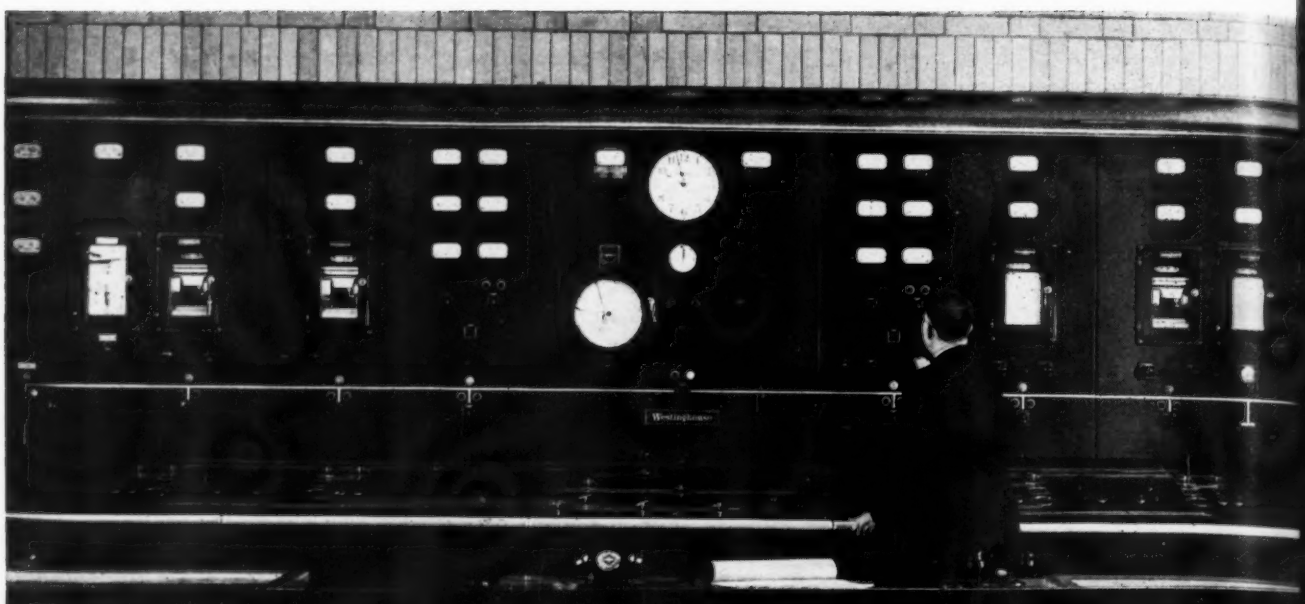


Fig. 1 — Panelboard, Lake Erie pumping station, from which the operator has control of two incoming power lines, two diesel-engine-driven generators to supply power in an emergency, all valves and four motor-driven pump-

Toledo's Water System Can Take It: Daily Pump Capacity ½ Billion Gallons

► COMPLETION OF TOLEDO'S ten-million-dollar Lake Erie water system came at an opportune time, for the advent of war found the city well prepared to provide thirsty industries with plenty of good, pure water. Had war started a year sooner it would have been a different story because the water system had become so inadequate for a growing, metropolitan Toledo that the dry summers found the pressure practically nil; at times almost no water was available. The original source, the old Maumee River, occasionally became dangerously low at the intake pipes.

For 50 years, old man river had served the community well, but the town grew to man's proportions and when dry summer heat boosted the pumping rate from 40 to 60 to 80 million gpd, and in one instance as high as 92 million, it was evident that without a new water supply the end of new industries and municipal safety was at hand for Toledo. To forestall this condition, city engineers set to work several years ago to plan for a new system. In 1938, under the direction of City Manager George N Schoonmaker, then chief of engineers, Division of Water, it was decided to utilize the unlimited supply of nearby Lake Erie in obtaining a dependable supply of cleaner, softer and purer water.

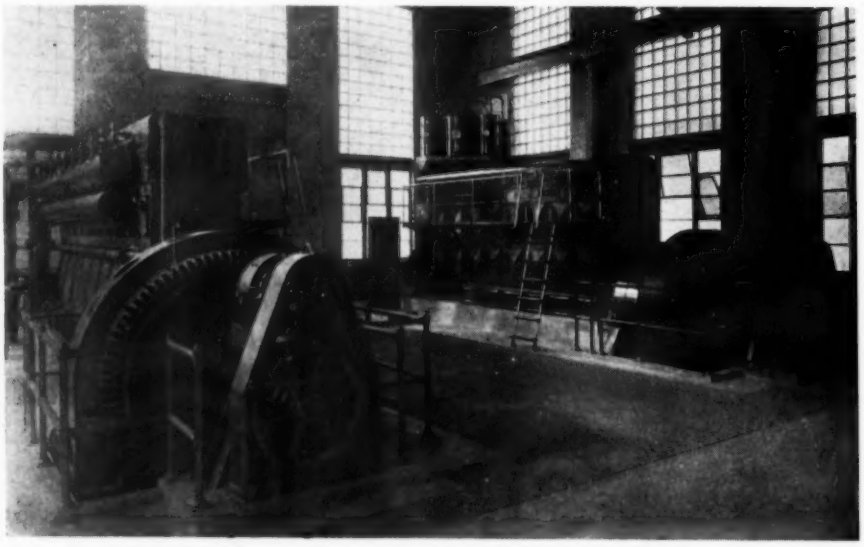


Fig. 3—Two 785-kva 2300-volt diesel-engine-driven generators, with exciter mounted over one bearing, that supply emergency power to the Lake Erie pumping station

Greeley and Hansen, consulting engineers, Chicago, were retained to make studies and prepare plans and specifications. The studies indicated that two pumping stations would be needed to force lake water through the lines to treatment and filtration plants and into the city mains. One station, with one 55-million- and three 50-million-gpd pumps, constructed near the lake (Lake Erie station), coordinates its pumping of raw water with another station, with two 55-million- and three 65-million-

Fig. 2 — One of three 1100-hp variable-speed slipring-motor-driven pumps in the Lake Erie plant, which also has one 700-hp variable-speed slipring-motor-driven pump, all operated from a centralized remote-control system

Two pumping plants, one driven by variable-speed wound-rotor motors and the other powered by synchronous motors of different speed, give wide range of capacity on new water system that supplies industrial plants, municipal needs and railroads in the Toledo area

By **GEORGE J VAN DORP**, *Superintendent, high service station and* **E M WILGUS**, *Superintendent, Lake Erie station*

gpd pumps, built at Collins Park in East Toledo, where treatment works and storage are likewise located. In 1941, Toledo received its first supply of water directly from the new lake source.

The pumping plants were completed none too soon, for on Dec 7 war struck the country. New industrial plants sprang up in the Toledo area, existing ones accelerated their requirements, railroads called for more and more water, and public safety and fire protection demanded increased attention. All these requirements the new Lake Erie water supply and pumping system met readily.

Apparatus to insure coordinated and controlled pumping, the key to smooth functioning of the entire system, was built and installed by Westinghouse. Pumps and motor drives were constructed by Worthington Pump & Machinery Corp, Fairbanks Morse Co, and Westinghouse. Motor-operated valves were built by Chapman Valve Mfg. Co.

In operation, the Lake Erie pumping station receives water by gravity flow through a 108-in. pipe from the intake crib two miles offshore, and forces it through nine miles of 78-in. pipeline, then through the chemical-treating building and into filter beds. One 700-hp and three 1100-hp variable-speed slipring motors drive the pumps, Fig. 2; all are operated by a centralized control system, Fig. 1.

Power for this plant is normally supplied from the lines of the Toledo Edison Co at high voltage and stepped down to 2300 v for the pump motors. As an emergency power supply, a diesel-engine-driven power plant has also been provided, Fig. 3. This plant has two 900-hp 360-rpm National Superior engines direct-connected to 785-kva 2300-v General Electric Co generators, with a 15-kw 1150-rpm exciter, mounted over

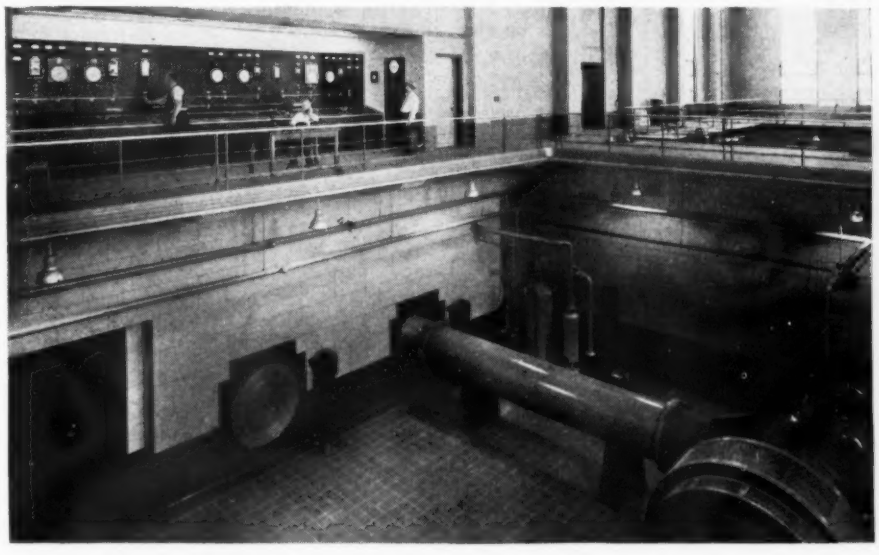


Fig. 4—Collins Park high-pressure station showing main control board and synchronous-motor-driven pump. Four double-synchronous-motor-driven pumps not shown

each generator bearing and V-belt driven from the generator shaft. These generators are able to start the 700- and 1100-hp slipring motors in the pumping station without difficulty. To insure the diesel plant always being ready for immediate operation, it is run about four hours each week supplying power to the pump motors.

Lake Erie Station Control

Control stands at the Lake Erie low-pressure station are arranged in the form of benchboards, on which the complete hydraulic and electric systems are outlined in miniature. Sloping panels have illuminated channels and symbols indicating valves, sluice gates and pumps. Open, closed, and other operating positions are illuminated. Thus the operator at all times has a complete picture of operation and direction of flow through the system.

Valves, gates, pump-priming controls, and various other pieces of apparatus are operated from these boards by means of keys or switches located adjacent to the symbol representing the equipment. Valve-operating handles project below the illuminated troughs, with their translucent covers, to drum switches where the circuits are set up as desired. The sloping bench is hinged so that it can be raised for easy access to the working parts without interfering with normal operation.

In a similar manner, the vertical part of the board shows a miniature layout of the high-voltage electrical system, with control switches for the circuit breakers properly located on the diagram. Pilot lights indicate whether the circuit breakers are open or closed. Directly above are the various electrical and water-flow meters, together with other instruments that indicate the operating condition of the entire system. The operator has at his fingertips the control of two incoming power lines, two diesel-engine generators for use in case of emergency, all valves at the station, and the rate of pumping.

At the Lake Erie station, the control board, Fig. 1, is normally lighted by power from the incoming lines. However, should the power fail, automatic switching connects a storage battery to strategically located emergency lights to facilitate starting the diesels. The board is located in an alcove on the main floor, with pumps in pits a few feet in front of it, metal-clad switchgear in the electrical room behind it, and the emergency diesel-electric generators a few feet to the left. Motor-operated resistors raise or lower pump speed by changing the resistance in series with the slipring motor-rotor circuits. Control of these motors provides for the dispersion of heat from their resistors by blower. In this way, power dissipated in the motor resistors helps heat the building during cold weather.

Collins Park Station

At the Collins Park high-pressure station, centrifugal pumps, Fig. 4 and 5 each driven by one or two synchronous motors, pump filtered water from the storage reservoir directly into the mains. Here it is necessary to control the rate of pumping carefully to maintain constant pressure through periods of wide water demand. This plant has five pumps, all synchronous motor driven. Two of them are each driven by a 514- and a 450-rpm motor. Two other pumps each connect to two motors, one running 450 and the other 400 rpm. The fifth pump is driven by a 514-rpm motor. These motors have ratings of from 1250 to 3000 hp, and provide many different combinations of pump speeds and capacities. The latter range from 49 to 65 million gpd against heads of 110 to 210 ft depending on pump speed.

As in the case of the Lake Erie station, all controls are centralized at one board. The general arrangement is the same except that the control equipment is different because synchronous motors are used. There are three 7200-v incoming lines, nine pump motors, and 32 electrically operated valves and sluice gates under constant supervision from this board.

The control benchboard of the Collins Park station and the single-motored pump, with provision for a future unit, are shown in Fig. 4. There are two other pump pits, separated by waterproof dividing walls for protection in case one pit should accidentally become flooded. At the bottom left in Fig. 4 is the wash-water pump room, in which is the 5-million-gpd wash-water pump. This pump, driven by a 440-v 1800-rpm synchronous motor, discharges into a one-million-gal high-level storage tank, supplies water needed for washing filters, and serves as a standby supply for short periods in the event of emergency or accidental shutdown of the main station. Controlled from the benchboard, the wash-water pump automatically maintains a predetermined level of water in the high-level storage tank.

Synchronous-Motor Control

Mimic hydraulic and electrical buses are visible in Fig. 4; the operating engineer is about to close a tie circuit breaker, connecting two of the three bus sections. The synchronous motors start directly across the line, their field coils being energized after a definite time interval. Five motor-generator sets, started automatically with the closing of the drum switch at the benchboard, provide field current for the nine motors. This switch also operates the main motor-oil circuit breaker. During

(*Continued on page* 136)

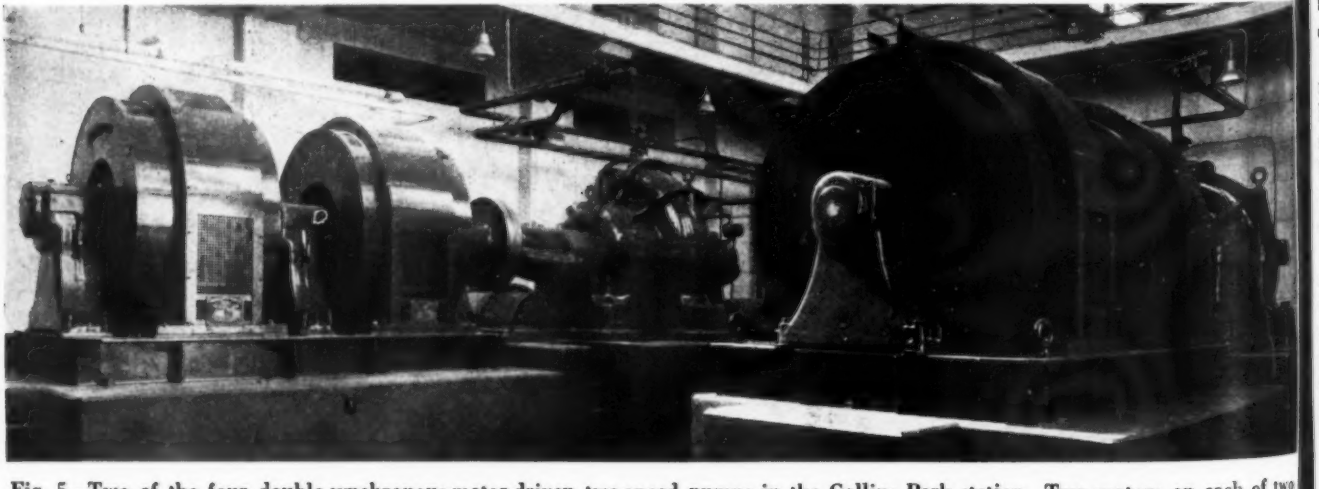
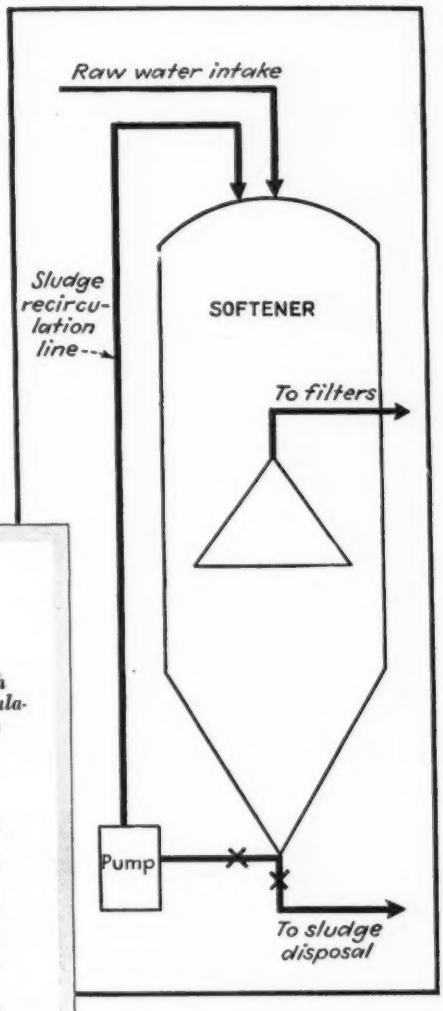


Fig. 5—Two of the four double-synchronous-motor-driven two-speed pumps in the Collins Park station. Two motors on each of two pumps operate at 514 and 450 rpm, and two motors on each of two other pumps operate at 450 and 400 rpm

Softener Works Better With Recirculated Sludge

Maxey Brooke, chemical engineer, Jefferson Lake Sulphur Co, Inc, experiments with sludge recirculation and finds 45% less suspended matter and 50% less silica in softener effluent, longer service without cleaning, reduced maintenance on lines and pumps, apparent increase in softener capacity



WATER ANALYSES

(parts per million)

	Without Recirculation	*With Recirculation*
Silica	6	3
Iron & Aluminum Oxide	9	5
Calcium	5	5
Magnesium	1	1
Sodium	467	467
Hydroxide	7	7
Carbonate	48	48
Sulphate	28	28
Chlorides	633	633
Suspended Matter	48	28

Fig. 1—On one of two softeners, small pump was rigged to redeliver part of discharged sludge to top of softener. This improved operation. (Sketch is by Joe Lester, engineer, of the Engineering Department, Jefferson Lake Sulphur Co)

FURNISHING A MILLION or so gallons of superheated (about 300 F) water daily for process is the main job of a sulphur-mine power plant. The great quantity of water heated accentuates scaling troubles in pumps, headers and lines, yet makes low unit-treating cost essential. The most usual answer is the hot-process softener.

Year's Experience

About a year ago, we decided to experiment with a suggestion that sludge recirculation might improve the hot-process operation. Accordingly, we connected a small centrifugal pump to one softener, Fig. 1, to collect part of the sludge from the bottom and pump it back into the top. For the sake of comparison, a second softener in parallel was left operating as before. The comparison, however, does not extend to percentage of sludge recirculation as it was not measured on the first softener.

Sludge recirculation produced immediate and marked improvement—for example. 45% less suspended matter and 50% less silica in the softener effluent to the filter bed. These reductions mean less load on filters and less chance of silica scale.

Operating gains were equally marked. The softener without recirculation had to be taken down every nine months for cleaning. Filter bed had to be air-agitated once a month. Pumps fed from the filters had to be descaled every six or seven months.

By contrast, the softener with sludge circulation is still on the line after 13 months. Filter beds were inspected once but needed no servicing. There was little scale in the pumps using this water. Moreover, it was possible to increase the load on this softener 10%. presumably because of sludge recirculation. although this cannot be definitely proved.

As to the theory of this operation, we have ideas if not convictions. Here are the hot-process reactions:

$$Ca(HCO_3)_2 + Ca(OH)_2 = 2CaCO_3 + 2H_2O$$
$$Mg(HCO_3)_2 + 2Ca(OH)_2 = Mg(OH)_2 + 2CaCO_3 + 2H_2O$$

In the first reaction, the calcium carbonate is precipitated as small crystals. Since it is a well-known principle of physical chemistry that the speed of crystallization is proportional to the number of nucleii present, it may be that the added sludge increases the rate of precipitation.

Not Sure How It Works

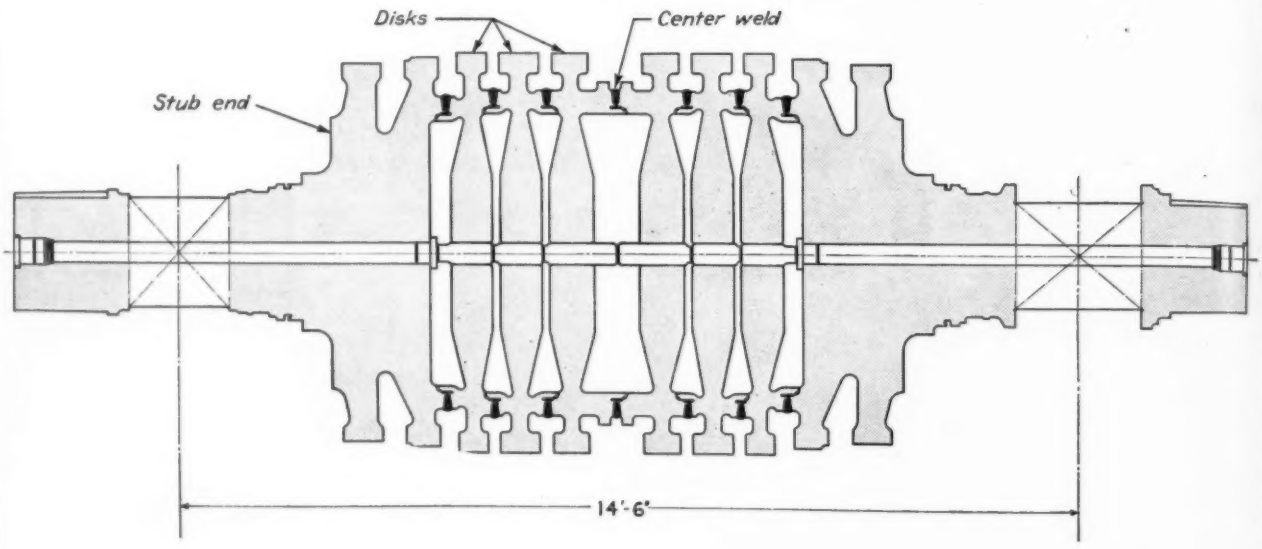
Again, the more rapidly crystals form, the smaller they tend to be. In this case, the blanket of sludge added to the softener would tend to sweep these small crystals to the bottom of the sludge cone.

The magnesium hydroxide precipitate, on the other hand, is jellylike and removes silica from water for reasons not yet fully understood. Sludge recirculation increases the concentration of magnesium hydroxide in the softener, and this causes more silica to be removed.

Whatever the right theory may be, a year's operation of one softener with recirculation has proved the process beneficial by:

1. Decreasing suspended solids in softener effluent
2. Decreasing load on filters
3. Reducing silica content of softened water
4. Reducing maintenance on lines and pumps
5. Probably increasing capacity of softener.

Welding Large Turbine Spindle



Six forged disks and two stub ends are joined by welds near the outer periphery of the spindle, resulting in rigid construction without requiring large forgings or shrinking disks on central shaft

Detail of Center Weld

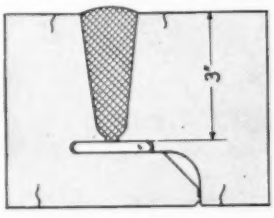
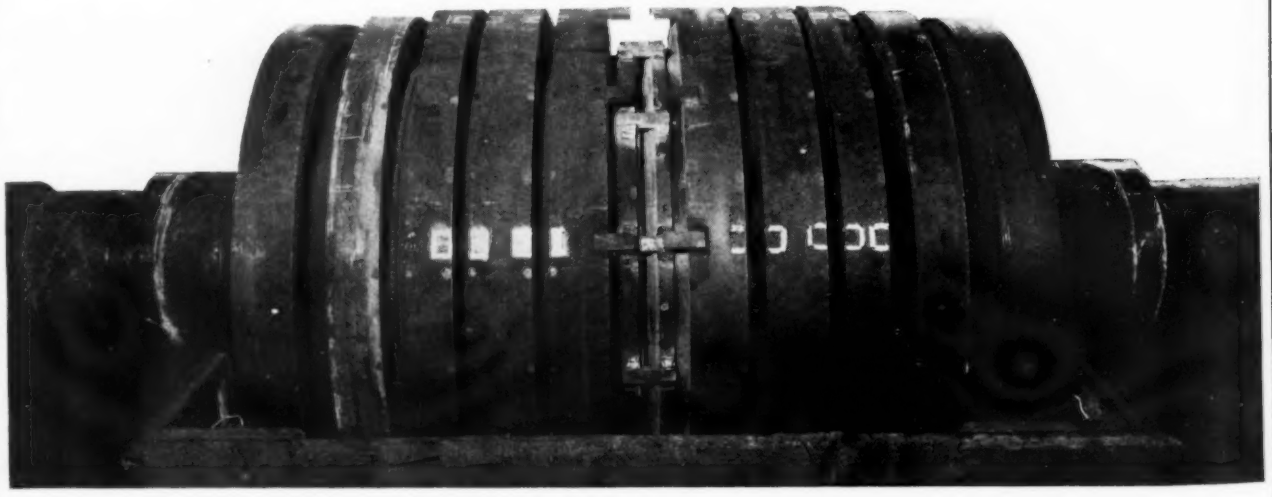


Photo shows semi-finished 76-in. spindle showing tacking strips in place for center weld. All welds were stress relieved and radiographed. Anticipated advantages of the welded fabrication were realized

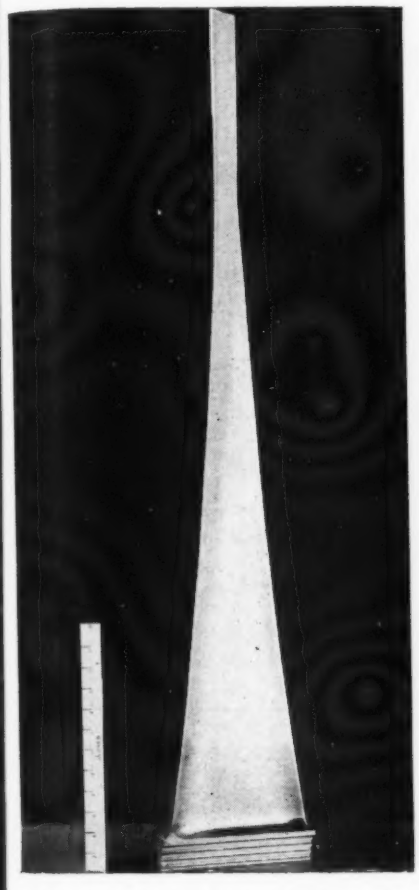


► A NUMBER OF ADVANTAGES are already apparent from a novel method of spindle construction employed on the main structure of a recently built large steam turbine. The largest spindle yet constructed in this manner, the 110,000-lb assembly is made up of six forged-steel disks and two forged stub ends joined by circumferential welds near the outer peripheries of the disks.

For a spindle of this size, welded construction has several advantages over the usual method of shrinking spindle rings on a solid shaft: (1) elimination in the disks of large bores that result in high tangential stresses, (2) reduction in weight carried by the bearings without sacrifice of strength or reliability, (3) reduced dimensions of component parts so that all forgings are made in the turbine manufacturer's own shops under supervision and control of their metallurgists, and (4) more suitable critical speed than is possible with usual spindle construction.

Because welding so large a spindle was unprecedented, special precautions were taken before and after actual welding. Test rings of the same material and approximately the same diameter were welded by the same general method later employed to join the actual spindle parts. In designing the

Novel fabricated construction saves weight, eliminates large bores in disks and reduces dimensions of forged parts for 110,000-lb spindle of new Allis-Chalmers 1200-psi unit



Axial-entry 36-in. exhaust blade to be mounted on 72-in.-diameter disk. Tip speed of these blades is 1138 fps

Infra-red and resistance heaters supply 40 kw to keep spindle at 500 F during welding. Turning rig revolves spindle at two turns per hour while welder works above, and helper operates peening hammer through hole in sidewall

spindle, provision was made for gamma-ray and Magnaflux inspection of the finished welds.

For welding, it was necessary to build an insulated hood that completely encased the parts. Infra-red and resistance heaters were installed inside the hood to apply the heat equivalent of 40 kw, to keep the spindle at 500 F during the entire welding period. A hand- and motor-turning rig was devised to rotate the spindle at two revolutions per hour while the welding was under way and during stress relieving when furnace temperature was raised to 1050 F.

After the spindle forgings were heat treated, stress relieved and machined, the spindle disks and ends were statically balanced. Three disks and one end were assembled by stacking vertically and tack welding tiebars across adjacent disks at six equally spaced points around the circumference. Openings were kept plugged to prevent entrance of foreign matter.

Once started, welding was carried on continuously on a 24-hr-a-day basis. The groove formed between disks was three inches deep, requiring accurate control of the continuous process of cleaning and peening. First and second layers were not peened, third was peened moderately and succeeding layers, sufficiently to maintain required gap dimensions. Distortion was constantly checked by measuring the distance between adjoining disks, and controlled by the amount of peening.

Welds on the first subassembly were built up to 60% complete, and the assembly rotated at temperature until placed in the stress-relieving furnace. After stress relieving, all welds were radiographed by introducing a radium-sulphate capsule through the central inspection hole with the film cassettes secured to the outside of each joint.

After repeating the procedure for the other subassembly, the two halves of the spindle were stacked vertically while twelve tiebars were tack welded across the center joint. During tack welding, adjacent halves were kept concentric and parallel to obtain specific over-all dimensions.

With the spindle raised to 500 F, as for each subassembly, the center joint was welded 60% complete and the end joints 100%. Even while no welding was in progress, the spindle was kept up to temperature and rotated at two turns per hour.

After stress relieving, the center joint was radiographed by introducing the capsule through radial holes in the central cavity. Then, after completing center weld, the entire spindle was given a final stress-relieving treatment.

The two rows of 36-in. exhaust blades are mounted in axial-entry grooves machined in the last 72-in.-diameter disk of each stub end. The remaining blade rows are fitted in circumferential grooves in the disks, the largest of which has 76-in. diameter.

Tip speed for the exhaust blades is 1138 fps. In future practice, blades of 40-in. length can be mounted on a drum of 80-in. diameter; under such conditions tip speed would be 1260 fps.

Spotlighting Refrigeration Facts for Apprentice Engineers

The "know-how" of a resourceful operator comes partly from understanding why, so A B Duryee, supervising engineer, explains clearly and simply many elementary details of refrigeration operation, such as the reasons for handling ammonia and Freon-12 differently

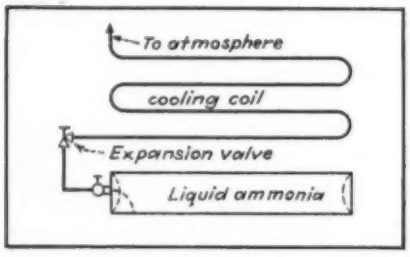


Fig. 1—Instead of wasting the refrigerant to atmosphere economy demands that we transfer it back to the receiver

▶ A REFRIGERATING PLANT provides for transfer of heat from one medium to another. Why? Because heat always flows from a warm to a cold body. This principle spotlights some easy-to-remember facts:

The unit of heat (British thermal unit, Btu) is the amount of heat required, in the range between 32 and 212 F, to raise one pound of water 1 F. *Sensible heat* produces the temperature of a substance that can be measured with a thermometer. *Latent heat* is the quantity of heat required to change the condition under which a substance exists without changing its temperature. For example, at 32 F adding 144 Btu to a pound of ice changes it to water, and at 212 F adding 970 Btu to a pound of water changes it to steam.

Boiling point, the temperature at which a liquid boils, depends upon pressure on the liquid and the kind of liquid. At atmospheric pressure, ammonia boils at —28 F and Freon-12 at —22 F. Increasing the pressure on a liquid raises its boiling point. If this were not true, liquids with low boiling points could not be kept in a liquid state. For instance, a drum of liquid ammonia stored in a warehouse at 40 F shows a gage pressure of about 59 psi. Stored at 90 F, the same drum shows a gage pressure of 166 psi. Most ammonia pressure gages have temperatures that correspond to pressures marked in red on the dial.

Every liquid has a combination temperature and pressure, called the *condensing pressure*, at which it remains in a liquid state. This fundamental law makes it possible to recover refrigerants and use them over and over.

If refrigerants, such as ammonia and Freon-12, were obtainable at no expense, a refrigerating plant's mechanism would indeed be simple. It would then consist of a container of refrigerant, an expansion valve and some form of evaporator or cooling coil, Fig. 1. But refrigerants cost money and so it is necessary to save and re-use them.

To accomplish this, the closed compression system was devised. Its simplest form, the direct-expansion system, expands the liquid into a gas at the cooling coils. Here we have a compressor, a condenser, a receiver, one or more expansion valves, and one or more sets of evaporators, or cooling coils, Fig. 2, which are nothing more than heat exchangers. Remember that the liquid, up to the expansion valve, is under the same pressure as that in condenser and receiver. When the expansion valve is opened slightly, the liquid flows into the cooling coils, which are at a lower pressure. There it starts to boil, then evaporates and turns into a gas. Heat to produce boiling is supplied by the coils' surfaces, which become colder as they give up heat.

If we stopped here, in a short time the same pressure could be built up in the cooling coils as in the condenser

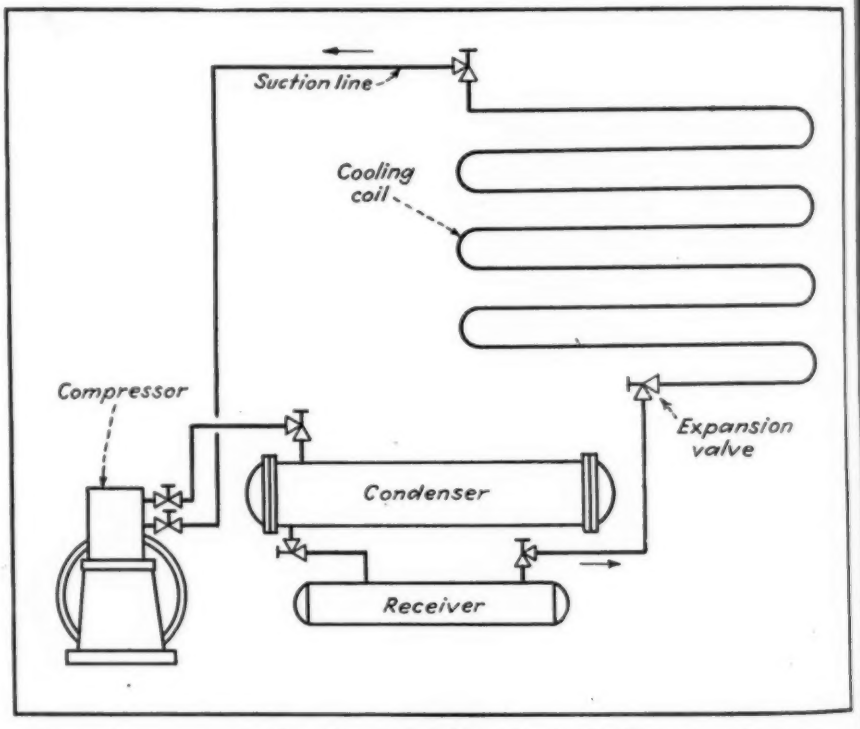


Fig. 2—A compressor and condenser completes the simple direct-expansion system

and receiver, but the liquid could not expand into a gas. So we connect a compressor to the end of the cooling coils and pump the gas away as fast as it forms. The compressor serves (1) To maintain reduced pressure on the cooling coils by removing the gas as fast as it forms, and (2) to raise pressure on the condenser. Cooling then restores the gas to a liquid state. Heat picked up by the gas in the evaporator coils is in turn absorbed and removed by the condensing water.

Inefficiencies

The direct-expansion system, while simple, practical and in very general use, is somewhat inefficient for a number of reasons, two of which are: (1) Any change in condition requires resetting of the hand expansion valve; (2) it is extremely difficult to obtain uniform heat transfer throughout the length of long coils. In other words, the entire surface does not work to full capacity. Any attempt to increase capacity by opening the expansion valve wider increases the danger of carrying liquid along with the gas—with possible damage to the compressor.

These defects have been overcome by the flooded system, Fig. 3, now in general use. Here we have cooling coils full of liquid whose level is maintained by a float valve—exactly as water level in a tank is maintained by a ball-cock valve. As the liquid boils, the gas rises to the surge drum at the top and flows to the compressor. With properly designed coils or plates, this arrangement permits the entire surface to function and provides maximum heat transfer.

Two Common Refrigerants

Let's consider two well-known refrigerants—anhydrous ammonia and Freon-12. Anhydrous ammonia is free of water. It boils at —28 F. and one cu ft at 55 F weighs about 39 lb or 5.2 lb per gal. Treat it with the greatest respect because liquid ammonia in contact with the skin causes serious burns.

Ammonia gas is extremely irritating to the mucous membranes and, in sufficient concentration, causes temporary blindness and strangulation that may prove fatal. It has a great affinity for water. In its pure state it is non-inflammable, but in the average refrigerating system, with an opportunity to come in contact with lubricating oil, it can and usually does form an inflammable mixture. In continuous use, it tends to break down slightly and form foul gas, which is non-condensable and has the same effect in the system as air. This so-called breaking down results largely from lack of care in manufacture and is usually beyond the operator's control, except that he can purge the system of this gas, as a later article will explain.

Handle Carefully

Properly handled, ammonia can be safely confined, but once out of control results are disastrous. Don't take chances—stop, think and take your time! Handle ammonia drums carefully. Don't drop them or store them where they are subject to high temperature. Don't overcharge your system but by all means carry enough liquid ammonia to seal the receiver's outlet under all operating conditions. This means keeping the receiver at least one-third full.

When necessary to add ammonia to the system, proceed as in Fig. 4: Ammonia drums are delivered with gross and tare weights stamped on a card that also shows the outlet valve's position. This valve carries an internal gooseneck, extending to the drum's inner wall, as shown in Fig. 4. Weigh the drum, then lay it horizontally with gooseneck pointing downward convenient to the charging connection in the liquid line, block up the end opposite the outlet valve about three or four inches, and wedge to prevent rolling. Connect drum to charging line, preferably with a flanged ammonia union. Use only good pipe with full, clean-cut threads. Remember, in extremely hot weather the ammonia is under possibly 200 psi pressure.

When piping is completed, open the drum valve slightly to check for leaks. Next, start compressor and open charging valve in liquid line wide; then open drum valve slowly. These valves are fitted with square stems. Don't use

(*Continued on page* 150)

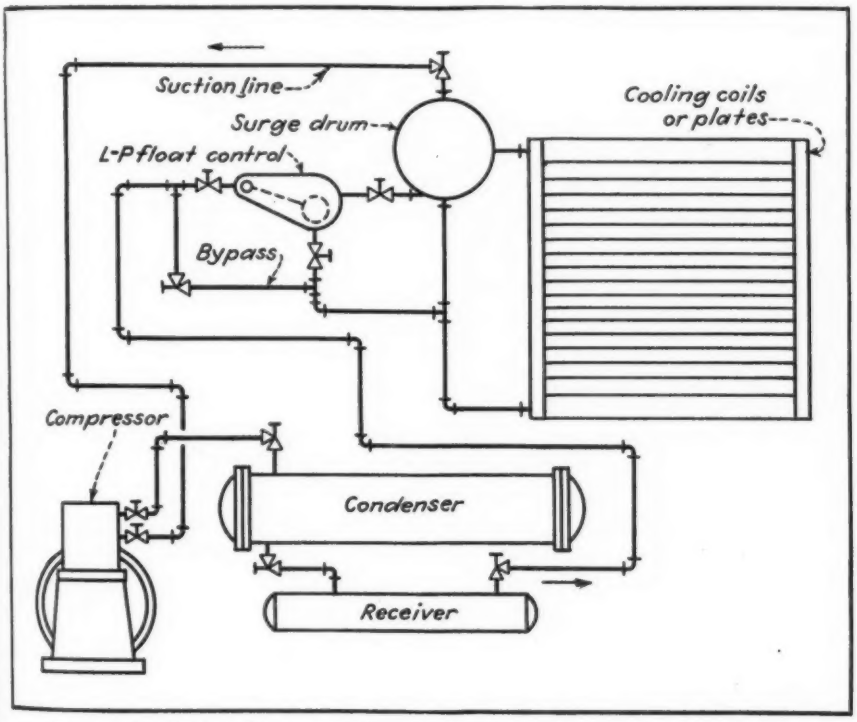


Fig. 3—Installing a float-operated expansion valve takes care of load changes

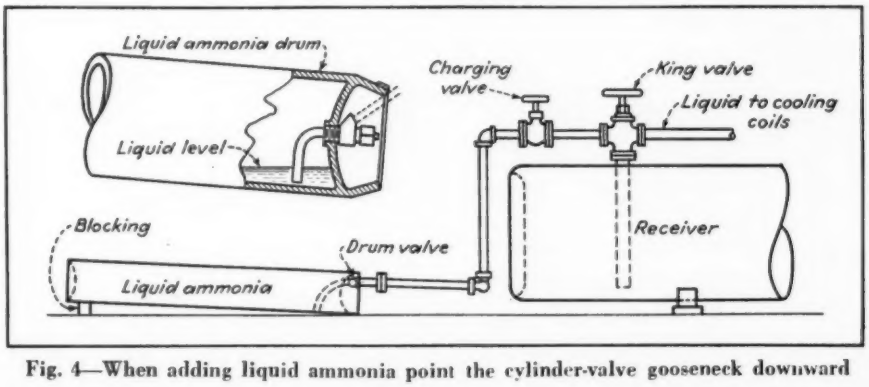


Fig. 4—When adding liquid ammonia point the cylinder-valve gooseneck downward

Copper-Oxide Rectifiers—Jack of Many Trades

J L Watts, Romiley, England, tells how copper-oxide rectifiers operate and then shows how they are used as rectifiers of alternating current and as check valves in electric circuits to permit current flow in one direction and not in the other

► COPPER-OXIDE METAL RECTIFIERS are widely used to change alternating into direct current at comparatively low voltages and currents. They also act as check valves in dc circuits. While they are simple, compact and require practically no maintenance, operating engineers should have a general understanding of the construction, operation and application of this versatile tool that solves so many problems in generating, distributing and applying electric power.

When a copper disk is heated to a high temperature, a cuprous oxide forms on its surface. If another copper disk is placed in good contact with the film on the first disk, we find that in one direction the disks have high resistance to flow of electric current and, in the opposite direction, low resistance. For example, if the oxidized disk, Fig. 1, is made positive, practically no current flows through the disks. Reverse the polarity of the disks, as in Fig. 2, and they become conductors.

Such an arrangement of copper disks makes it possible to rectify ac into dc. For instance, in Fig. 1 and 2, when connection is to an ac circuit, current flows through the disks during one-half cycle when the copper disk is positive, and ceases to flow during the other half cycle when the oxidized disk is positive. This is called half-cycle rectification. Similar rectifying properties are found in selenium, iodide, sulphide of silver and other materials.

(*Continued on page* 142)

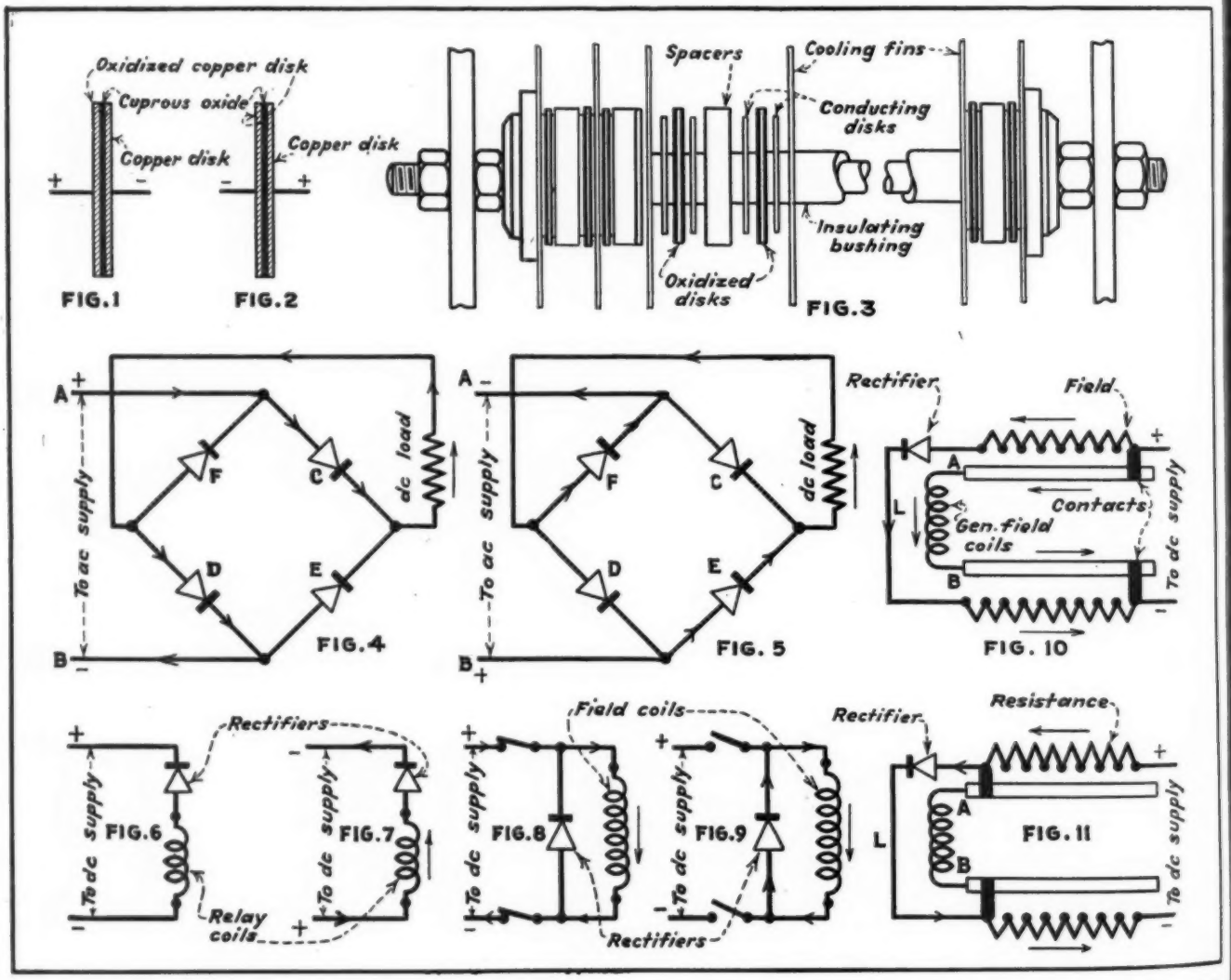


Fig. 1 and 2—Elementary diagram of a copper-oxide rectifier. Fig. 3—Diagram of the general assembly of a copper-oxide rectifier. Fig. 4 and 5—Arrangement of copper-oxide rectifiers to give full-wave rectification. Fig. 6 and 7—Here a copper-oxide rectifier connected in series with a relay coil permits operation of the relay on current flow in one direction only. Fig. 8 and 9—Copper-oxide rectifier connected across generator field coils serves as a discharge resistor. Fig. 10 and 11—Rectifier serves as a check valve in a generator potentiometer-rheostat circuit to cause rapid decay of the generator field flux

Ready Reminders for Stoker Operators

Hints for greater efficiency and less outage in wartime operation and maintenance condensed into a handy check list by H C Linderman, stoker supervisor for Westinghouse

▶ THEY'RE REVIEW STUFF to the old-timer, but to a man on his first day in a boiler-room, common-garden-variety details of everyday operation are front-page news. Efficient use of every pound of fuel, as well as continuous steaming for long periods, depends on day-to-day checkover of stokers and furnaces. This digest should be second nature to every operator:

Instruments

Draft gages. Check regularly to assure correct indication of operation conditions.

Steam and feedwater meters. Check for load changes and adjust stoker for maximum economy. Note manufacturer's instructions.

Steam-flow air-flow meters. Check CO_2 occasionally by Orsat.

Air Requirements

Too little air—too much fuel. This combination wastes heat of partially burned fuel. Hot grates result; grates burn; ash melts and forms large, sticky clinkers; fuel bed mats over and makes air pressure rise. Wherever air can get through fuel bed, it travels too fast and causes smoke.

Too much air—too little fuel. This combination wastes heat, requiring more coal and producing more ashes. Excess air keeps grates cold and cools hot gas.

Operation

Adequate Draft. When boilers operate at high ratings, lack of adequate draft causes more burning of stokers and brickwork, more clinker trouble and more smoke than any other factor in boiler operation. Operate stoker with fairly uniform excess air over entire area. Watch for leaks.

Fuel Distribution

Spread coal evenly. Distribute over grate surface so that actively burning coal covers all areas where air flows.

Spread coal to proper depth. Fuel-bed thickness should permit intimate mixture of coal and air at all points without developing "holes."

Ash and Clinkers

Protect grates. Keep some ash on stoker grates to act as an insulator.

DAILY OPERATING LOG

Plant_____ Boiler No._____

Location_____ Date_____

	Shift
Fireman	
Boiler service hours	
Boiler bank hours	
Outage	
Tons of coal burned	
Steam generated	
Actual evaporation	
Boiler blowdown	
Operation of soot blowers	
Steam pressure	
Feedwater temperature	
Boiler-exit gas temperature	
Automatic lubricators filled	
Oil feed checked	
Moving parts greased	
Inspection: stoker moving parts	
Check of:	
Motors and instruments	
Forced draft fans and drives	
Boiler-feed pumps and heater	
Coal-handling equipment	
Ash-handling equipment	

First principle of good boiler-room operation is adequate log-keeping to spot instantly any changes that indicate need for maintenance and to serve as instruction for performing necessary work

INSPECTION SUMMARY

Plant_____ Boiler No._____
Date_____
Location_____ Date of last report_____
Tons coal burned_____
Boiler service hours_____
(including bank)

Equipment	O K	To be repaired
Front and brickwork		
Retort and retort throat		
Secondary ram; ashpit dampers		
I-Beams and stationary plates		
Ram and grate-operating mechanism		
Compensators		
Demountable and dump grates		
Stationary grates		
Stoker drive		

Comments_____

Move ash. As fast as new ash is deposited, move it to discharge section.

Boiler and Furnace

Candle settings. Examine thoroughly with candle for possible leaks. Check these points: (1) expansion joints in brickwork, (2) places where boiler drums, waterwall circulators and headers, superheater tubes and headers pass through brickwork, (3) brickwork built around columns or beams, (4) joints in steel casings, (5) joints between waterwall casings and brick walls, (6) setting of doors and frames, (7) wall sleeves for soot blowers.

Automatic Regulation

Steam-pressure regulator. Keep changes in rate of air flow and coal feed in step so that they require only minor adjustment—operate within a pressure variation of about 5%, if practicable.

Feedwater regulator. Uniform flow of feedwater is essential to good regulation. Sudden reduction of flow causes steam pressure to rise rapidly, while sudden inrush causes pressure to drop.

Stokers

Starting fire. If coal has an ash content of less than 7%, cover grates with a layer of ashes about 1 in. thick before laying the fire. Spread coal manually to uniform 3-in. depth. When boiler is under load, keep coal in hopper at all times. Operating with it empty may damage the retort.

Maintaining fuel bed. Adjust secondary ram stroke to distribute coal uniformly from front to rear. Always stop stoker by shutting off power when changing secondary ram stroke.

Dumping ash. Do not follow a fixed schedule. Dump when ash accumulation over dump grates is sufficient to be well burned out and before it retards fuel-bed movement and clinkers form. While dumping, stop stoker and reduce air pressure to not over 0.5 in. Drop dump grates, then raise before looking into furnace. Do not rake ash and fuel from stationary plates or moving grates.

Banking. Do not dump ash just before banking, but burn fire down thinner than normal. Before banking, run hopper empty or, if necessary, after banking run stoker several strokes every hour to empty hopper without building up fuel bed excessively.

Precautions

Watch draft. Maintain a draft of 0.05 to 0.10 in. in the furnace at all times, including banking.

Check slag. Keep furnace walls free of slag accumulations as they interfere with fuel movement and combustion.

Lubricate regularly. Fill automatic lubricators and grease moving parts daily.

Will Colloidal Fuel Stretch Next Winter's Fu

If current tests prove successful, mixtures of coal and oil, centrally produced and distributed, may become available to extend rationed supplies for plants that cannot convert

► Is COLLOIDAL FUEL a "way out" for oil-burning plants that cannot convert? Some engineers think it is. Skeptics point to practical difficulties and want answers to these questions: Can colloidal fuel be prepared and distributed economically? Can the mixture be made sufficiently stable to permit shipment and storage for reasonable periods, without settling? Can ordinary oil burners and furnaces handle this fuel without extensive alterations or operating difficulties? Answers to some or all of these questions will come from tests now being made in several plants and reported briefly here.

Shortage Revives Interest

Today's revival of interest in colloidal fuel stems directly from the oil shortage. Mixing finely pulverized coal with fuel oil, to make colloidal fuel, saves oil roughly in proportion to amount of coal added. On the basis of the usual mixtures, which run 30-40% coal, by weight, successful use of colloidal fuel would effect a saving of about one-third in oil consumption and thus would stretch rationed supplies by that amount. The conversion program will, of course, continue as planned. Fig. 1, and represents the major oil-conservation activity. Use of colloidal fuel, if practical, will serve to "stretch" oil supplies available for plants that find conversion impossible, and will help keep normal channels of fuel-oil distribution in operation.

Government investigation of colloidal fuel as a possible answer to the oil problem began more than a year ago in the form of technical studies by the Bureau of Mines to find out what had been done by past experimenters and to lay down the best path of approach to the problem. These studies indicated that an oil-coal liquid fuel can be made in three basic ways: (1) the mixture can be made sufficiently stable to avoid settling under normal conditions, (2) an easier and cheaper to make but less stable mixture can be produced and stirrers provided in tanks and transportation equipment, or (3) the oil and coal can be mixed at the point of use. Of these, most current interest attaches to the first, which seems best suited to the problem of supplying a substitute fuel to plants equipped for burning oil only. Mixing at the point of use offers possibilities for larger plants and it is reported that one such installation is now in operation.

A recent report presented by the Marketing Division, Petroleum Administration for War, also comes to the conclusion that bulk production and distribution of colloidal fuel offers most advantages. This report estimates that

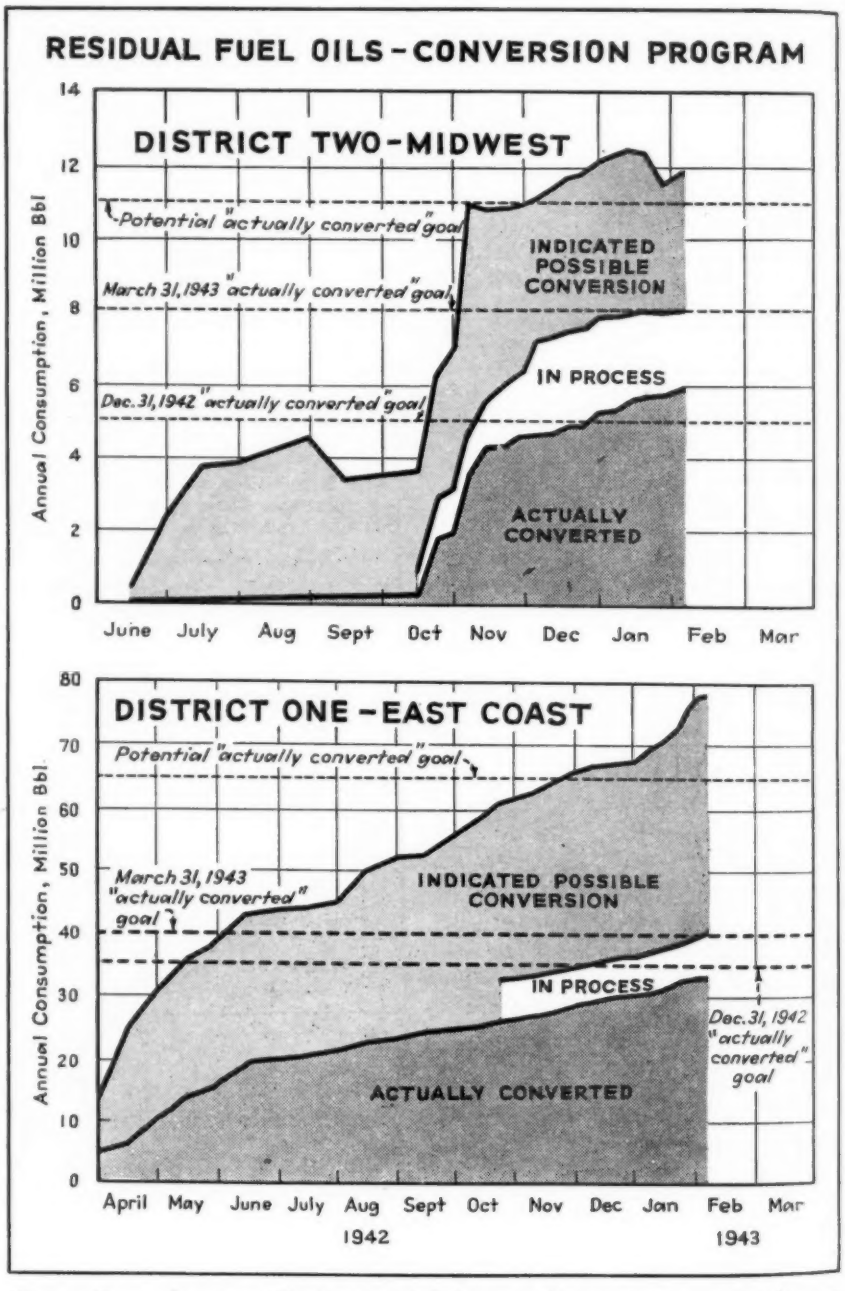

RESIDUAL FUEL OILS - CONVERSION PROGRAM
DISTRICT TWO - MIDWEST
Annual Consumption, Million Bbl
Potential "actually converted" goal
March 31, 1943 "actually converted" goal
Dec. 31, 1942 "actually converted" goal
INDICATED POSSIBLE CONVERSION
IN PROCESS
ACTUALLY CONVERTED
June July Aug Sept Oct Nov Dec Jan Feb Mar
DISTRICT ONE - EAST COAST
Annual Consumption, Million Bbl
Potential "actually converted" goal
March 31, 1943 "actually converted" goal
INDICATED POSSIBLE CONVERSION
IN PROCESS
Dec. 31, 1942 "actually converted" goal
ACTUALLY CONVERTED
April May June July Aug Sept Oct Nov Dec Jan Feb Mar
1942
1943

Fig. 1—Charts show, for Districts 1 and 2, how much annual oil consumption can be saved by conversions from oil to coal and the amount of oil saved annually by conversions actually made and in process. Even if conversion goal is met, oil supplies must be rationed; colloidal fuel offers a possible means of stretching these rationed supplies, aiding plants that cannot convert to coal-fired operation

r' Fuel-Oil Supply?

on the Atlantic seaboard (District One) colloidal fuel could be used in plants having a total annual oil consumption of 30,000,000 bbl. About one-third of this amount could be saved. This 10,000,000-bbl gain, along with another 5,000,000 bbl from District Two, makes a total potential saving of 15,000,000 bbl per year. Parts of the report dealing with costs and with location of colloidal-fuel plants will be discussed later.

With emphasis on central production of colloidal fuel, for distribution through regular channels, the question of mixture stability becomes a top-ranking problem. As far back as 1879 experimenters tried adding "stabilizers" or "fixateurs" to the mixture to keep the coal in suspension. Numerous patents cover use of metal soaps, fatty acids and coal tars for this purpose. Results leave much to be desired and most of today's work centers around fine grinding or other mechanical means for maintaining suspension.

Tests Now in Progress

Just how finely pulverized the coal must be is one of the answers hoped for from the series of tests being run at the Point Breeze plant of Atlantic Refining Co. Using a spare unit in an isolated boiler house, Bureau of Mines engineers are carrying out comprehensive tests on the properties of oil-coal mixtures and on their behavior in a boiler furnace. The tests are being supervised in behalf of the Bureau of Mines by J F Barkley, Chief, Division of Solid Fuels for War. Dr. Arthur B Hersberger, of the Atlantic Refining Company, is directing the company's technical experimentation.

Convenience dictates mixing by the batch system; the ingenious arrangement used shows how simply the mixing may be accomplished. As shown diagrammatically in Fig. 2, a duplex pump takes its suction from an 11,000-gal horizontal steam-heated tank. A tee in the suction line carries a short vertical stub pipe and a valve. Coal feeds into the suction lines through a large funnel mounted on the stub pipe. The pump discharges the coal-oil mixture back into the storage tank at the top.

Pulverized coal is manually fed into the funnel at the rate of about 1600 lb per hr, with a pumping rate somewhere in the neighborhood of 150 bbl per hr. The mixture runs 40% coal, by weight.

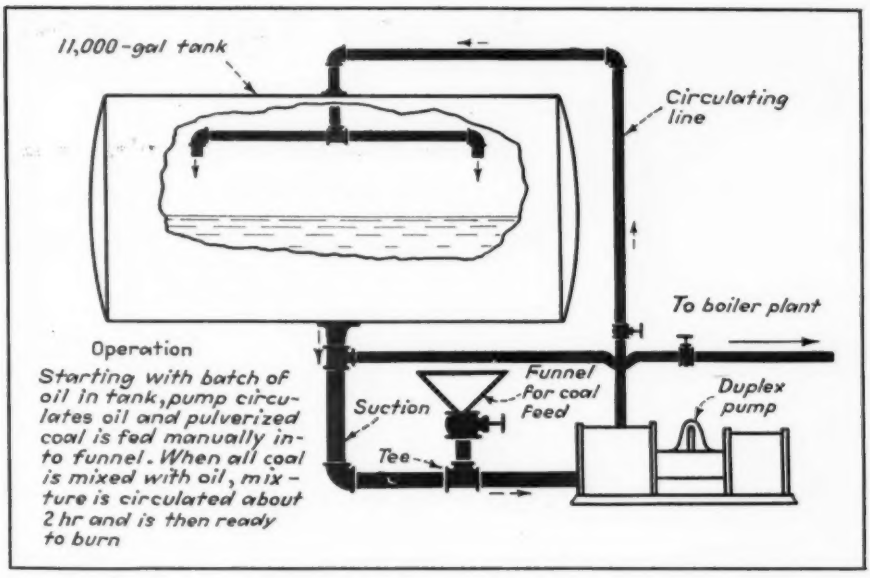

11,000-gal tank
Circulating line
To boiler plant
Operation
Starting with batch of oil in tank, pump circulates oil and pulverized coal is fed manually into funnel. When all coal is mixed with oil, mixture is circulated about 2 hr and is then ready to burn
Funnel for coal feed
Suction
Tee
Duplex pump

Fig. 2—Diagram shows general hookup for mixing colloidal fuel at one plant

After the mixture is complete, it is recirculated for about 2 hr, to insure thorough dispersion of the coal. The oil used runs about 55-65 Furol viscosity; this jumps to 500-600 after mixing. The steam coils in the tank maintain about 85 F in the suction area. The heating-steam line parallels the colloidal-fuel supply line into the plant; this heat pickup gives a temperature of about 95 F at the rotary pump that supplies the burner.

The rotary pump discharges the colloidal fuel at about 30-40 psi to the preheater and thence by a 2-in. line for a distance of about 100 ft to the boiler. Pressure at the Best steam-atomizing burner runs about 3 psi and temperature about 130 F. Rough calculations indicate steam consumption for atomizing runs about 3.5 to 4 lb per gal compared with about 2.5 to 3 lb per gal on straight fuel oil.

Data on Mixtures

In April, when a POWER editor visited this installation, the third batch of colloidal fuel was in use. The first consisted of 6000 gal and the coal was ground to 95% through 230 mesh; no settling was evident in the tank. The second batch, 7000 gal with the coal ground to 88% through 230 mesh, showed some slight settling toward the end of the run, about 7 days. The third batch consisted of 10,000 gal; the coal ran 98% through 230 mesh. All batches were about 40% coal, by weight. The coal analyzes about 6-8% ash and 37% volatile, with low sulphur and an ash-fusion temperature of about 2400 F.

The Bureau of Mines will publish complete test data on the fuel characteristics and on its performance in the B & W long-drum refractory-furnace boiler. Preliminary observations indicate about 14-15% CO_2 and a temperature of about 1700-1800 F at the first tube row. Experience shows that soot and ash accumulations on the tubes require blowing about once each 8-hr shift; flue-gas temperature rises about 20 F in that time, which is only slightly more than was observed on oil. No trouble has been experienced with slagging and there have been no burner difficulties. Operation on each batch of fuel has been continuous.

Use of "Colloid" Mill

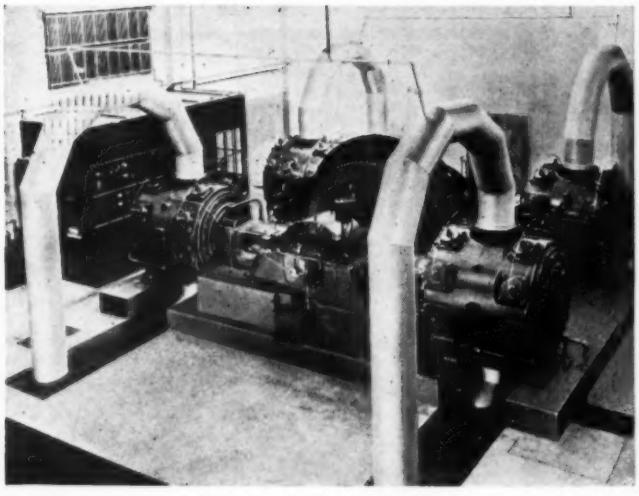
An entirely different method of preparing colloidal fuel is used at the pilot plant built by J G Coutant, consulting engineer, at Metropolitan Petroleum Corp's bulk terminal at 136th St and East River, New York. Here also experimental limitations dictate mixing in batches. Starting with ordinary pulverized coal received from a nearby central station, a batch is made up by mixing the coal into oil heated to about 160 F. This mixture then flows through a "colloid mill" for further grinding. This unit, similar to those used for grinding paint and food products and for homogenizing milk, consists of two disks inside a casing; one disk is fixed and the other is motor driven. The material to be ground enters at the center and flows out to the edges between the disks, which nearly touch.

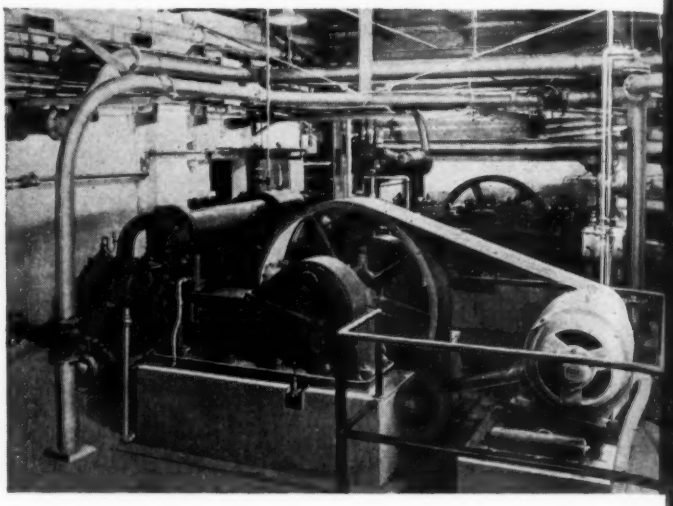
Mixtures made by this method have varied from 25 to more than 50% coal, but 40% seems the best all around figure. Determination of particle size becomes difficult when final grinding occurs after mixing with oil. However, the

(*Continued on page* 146)

Before You Select Air-Compresso

Plan your installation complete in all details as an expert would, says C Kohl, Worthington Pump & Machinery Co, so that you will have the mo economical drive and one that produces minimum building vibrati





▶ WHEN A POWER-GENERATING PLANT is being planned, consulting engineers are usually engaged to determine from an economic standpoint what kind of equipment will best serve plant needs—whether motive power will consist of steam or diesel engines or steam turbines. Over-all calculations also include future as well as present requirements, to provide a distribution system of adequate capacity with reserve space for future expansion.

Is the same procedure followed when planning a compressor installation? Unfortunately, no; selection is invariably by rule of thumb. But what are the important points that should be analyzed before making a selection?

First: Determine actual amount of air needed for expected operations. This information may be secured from companies that supply air-consuming equipment. Plant-operating cycle then determines load factor on these tools.

When all air requirements are known, increase the figure 50%, then divide total load between a minimum of two compressors. The 50% increase represents spare capacity—a reserve that protects the production schedule because output can be increased later by using air in operations that previously had not been air operated. Since compressors are mechanical equipment and naturally require some maintenance, the plant with at least two compressors is never totally without air during outage of one unit for repairs.

Second: Consider the type of drive, after determining size of plant and number of units needed. Generally, first thought is for a motor-driven installation, but it is best not to arrive at a hasty decision. Perhaps a better plan lies in first considering the various kinds of motive power. For each of the following drivers there is a niche where it is the best possible selection from considerations of first cost, operating economy and reliability: (a) Steam—either direct-connected steam engine or turbine; (b) oil—either diesel or gasoline engine; (c) gas—natural or manufactured-gas engines.

Electric Power

A plant served with electrical energy at reasonable rates, having no problems of frequent or prolonged current interruptions and requiring no steam for process work, usually finds electric motor drive best. As a rule, compressors that require drivers larger than 100 hp are synchronous-motor driven, Fig. 1, with the motor mounted directly on the compressor crankshaft. This conserves space and eliminates belt maintenance. Usually, smaller units use belt drive to reduce initial investment when belt replacements are not an extremely expensive item Fig. 2.

Steam-driven compressors, Fig. 3, generally prove most economical in plants that generate steam for process or for electrical energy. The tabulation shows the economics of installing steam-driven compressors to supply the air requirements of a large airplane propeller manufacturing plant. This plant needed an amount of process steam that, if generated at higher pressure, would supply, at practically no cost, at least half of the compressed air in summer and all of it in winter. Because exhaust steam from the compressor supplies heating and process, only 10% of steam cost, or 19.1 cents per hr, is chargeable to the compressor. Therefore, cost of 1000 cu ft of air is:

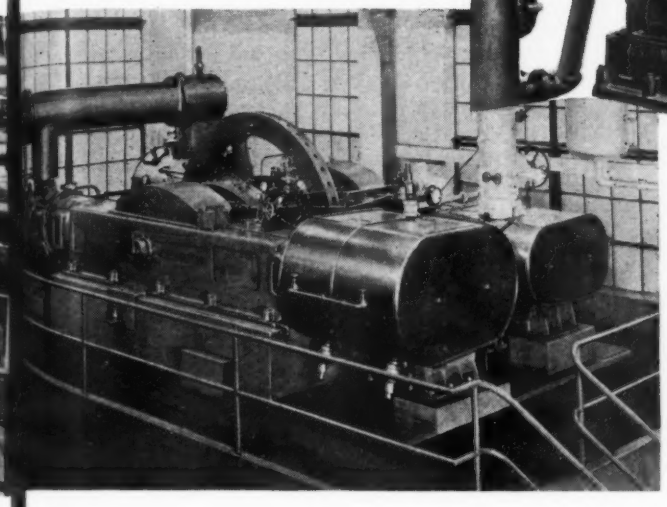
$$19 \div (800 \times 60) = 4 \text{ mills.}$$

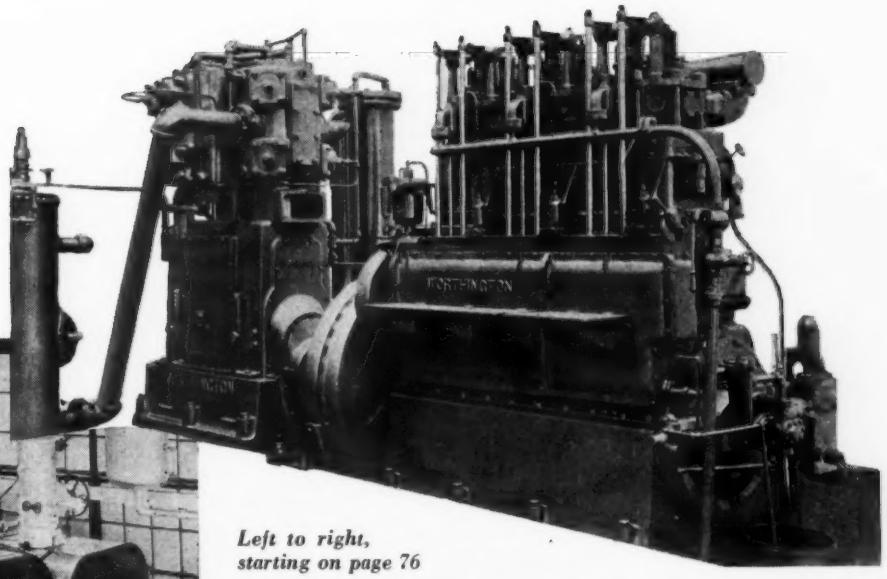
In summer, the plant requires steam only for process work up to a maximum of 3500 lb per hr at 10 psi. At this exhaust pressure, the compressor water rate falls to approximately 27 lb per hphr. Then,

Total hourly steam	4450 lb
Process requirements	3500 lb
Steam wasted	950 lb
Cost of steam wasted	$0.35
10% of process steam cost	0.12
Total hourly operating cost for 48,000 cu ft of air	0.47

...rive—

...mitted in the "Compressed ...n Industry" contest sponsored ...the Compressed Air Institute.





Left to right, starting on page 76

This balanced, opposed unit, Fig. 1, serves well when placed on poor soil foundation because of its low shaking force

Motor- and steam-driven units, Fig. 2, make a good combination for summer and winter to provide steam heating

Plants that generate steam for process or electrical energy, Fig. 3, get low-cost air with these large steam-driven units

Investigate diesel- or gas-engine drive, Fig. 4, when rates for the kind of fuel used in this equipment are economical

Cost per 1000 cu ft in summer: 1 cent

These figures are based on full compressor load; at partial load, there would be no waste steam in summer, thereby further cutting operating costs. Considering electric-motor drive on a basis of 20.6 hp per 100 cu ft and 92% motor efficiency, kwhr for 6000 cu ft delivered equals 16.70. At 1.4 cents per kwhr, total hourly cost equals 23 cents, or 3.8 cents per 1000 cu ft.

Based on this analysis, two 800-cfm steam-driven compressors operating at 165 psi initial steam pressure and exhausting to 35 psi were installed, together with one 900 cfm motor-driven unit. During seven months of the year the two steam-driven machines operate; during the summer months one steam-driven unit supplies base air load and process steam requirements, with the motor-driven unit supplying the balance.

Oil- or gas-engine-driven equipment, Fig. 4, serves best when: (1) these fuels are available at economical rates, (2) it is desirable to have a compressed-air system independent of other utilities or (3) installation is in a remote section, such as an oil field or construction job not served by utilities.

A large airplane manufacturer who needed a compressed-air system that was not dependent on the public utility —from which they normally buy power, but which could not guarantee uninterrupted service during electrical storms —installed diesel-engine-driven compressors. These units also have generators mounted on the engine shaft. On complete power failure, the air compressor may be either wholly or partially unloaded; the engine-driven generator then keeps the plant operating until utility service is restored.

A fair idea of the relative operating cost of various drives may be obtained from the following power-consumption rates of a 2-stage unit having an actual delivery of approximately 1500 cfm, compressing from atmosphere at sea level to 100 psi:

Motor.....372 cu ft per kwhr
Steam.....13,600 cu ft per 1000 lb[1]
Diesel.....5600 cu ft per gal
Gas engine.....30 cu ft per 1000 Btu

[1] Based on 150-psi steam, 50-F superheat and 5-psi backpressure. Increase or decrease 6% per 25 psi change in steam pressure.

Approximate cost of this size compressor, equipped with air receiver, aftercooler, intake filter, driving equipment and control, but excluding foundations, piping and wiring, is:

Motor-driven $16,200
Steam-driven 18,000
Diesel-driven 31,000
Gas-engine-driven 24,000

Third: Shall single- or two-stage compressors be installed? When units have an actual delivery in excess of 300 cfm at a pressure of 100 to 125 psi, it is advisable to use two-stage machines because they use 11% less power than single stage at 300-cfm capacity, 14% less at 450-cfm, and 19% less at 1500-cfm—all capacities at 100-psi delivery. When one year's power cost for operating a compressor approaches its initial cost, economy of operation is important.

(*Continued on page* 150)

Winter Operating Cost of 11x18/11x14 Worthington Compressor

Total air delivery	800 cfm at 125 psi
Total horsepower	165
Steam per hp per hr (165 psi and 35 psi exhaust)	33 lb approx
Total steam per hr	5,450 lb
Air delivered per hr	48,000 cu ft
Cost of steam, basis 35 cents per 1,000 lb	$1.91 per hr

The Old Chief: Unblessed by Instruments

In his remarkably human series exclusive to POWER, William Doran, chief engineer, Essex County Sanatorium, Windsor, Ontario, writes about an engineer of the past generation whose homely philosophy is punctuated by glints of kindly humor and hard common sense

▶ EVERYONE WHO HAS WORKED around a steam plant recalls times when something or other was lost and every mother's son in the place assumed the role of *bloodhound* and started to track down the missing article. On the occasion that I have in mind the object of our search was the basement plans of one of the buildings.

They finally turned up in the architects' office downtown after many assurances from that quarter that *they knew nothing about them.* I have clean forgotten what we wanted the plans for, but I remember that in our prowling we discovered a dusty old box, which contained among other things a number of very old monthly reports that were in the Old Chief's handwriting and dated back to the early days of the plant.

Yardstick Coal

When I had time to look over the reports, they presented a big mystery because I knew that at the time they were written there were no flowmeters or measuring instruments in the plant. Yet, the monthly reports presented a full statement of raw materials received, that is to say, coal, electricity, water, replacement parts, etc. On the other hand, there were charged out to each separate department in round figures steam, power, lighting, heating, water, hot water, repairs and materials.

Under the heading of coal, there were coal purchased and tonnage received. From this was deducted coal on hand. I asked the Old Chief how he computed this latter figure, and he explained that you just walked into the bunker with a yardstick and a good imagination and figured it out at about 42 cubic feet to a ton. This was easy to understand—especially the strain on the imagination.

Taking the fireman's tally of 400-lb wagonloads of coal, the process steam to one department was based on running costs on the average days when that department was not working, with the average on the days when a full load was on. In the same way, a close check on the one lone water meter established that the finishing department used one out of every three gallons of water used in the factory. Further checking established the average proportion of each of the other departments so that the bill from the water works was charged out at a fixed ratio.

After many assurances from the architects' office that they knew nothing about the basement plans of our building, they finally turned up down there

In our prowling we discovered a dusty old box of very old monthly reports dating back to the plant's early days

In parceling out heating costs, the known normal summer load was deducted from the winter load and the balance was charged pro rata on the basis of cubic content of buildings serviced. Electricity was purchased at 4000 volts and stepped down to 220 (3-phase) and 110 volts. With the aid of meters borrowed from the utility company and the kind assistance of their meter department, a number of fixed working-hour costs were established in each department. The balance, lighting and plug service, fluctuated with the season. This, in turn, was charged out on the basis of the area lighted.

Guesswork Foundation

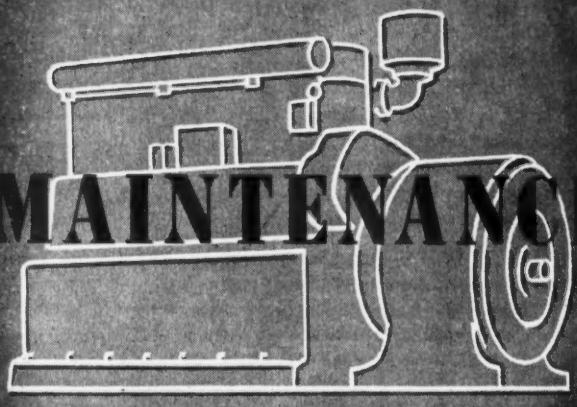
I started out to tease the Old Chief on the guesswork foundation of all the items. I claimed that the charges were not only inaccurate but that they would not reveal preventable losses or unseen wastage. I also argued that fixed charges would penalize departments that were interested in reducing costs and that his cost-plus charges had no relation to the quantity or quality of the services received.

The Old Chief smiled and, taking my arm, pointed out the instrument panels that now graced his plant. "Son," he said, "every one of these I owe to the inaccuracy of those old report sheets. If ever you are in a small plant, take the trouble to show the owners that the power plant is not just a necessary evil nor a bottomless pit into which ungodly amounts of money are poured.

"Show them by the best means at your disposal that you are transforming raw materials into salable necessities. Do this and you will have very little difficulty convincing them of the practical advantage of up-to-date measuring instruments."

Looking over the old reports to find further fault, I asked him why he charged repairs to a particular department instead of to maintenance. He replied that he belonged to that school of thought that charged *everything to someone* except his friends' drinks.

DIESEL- AND GAS-ENGINE MAINTENANCE



By L N ROWLEY, *Associate Editor*

ON LAND AND SEA, with the armed forces and in industry, wherever generators hum, wheels turn, and propellers spin, internal-combustion engines roll out a steady stream of war-winning power. The job of keeping that power stream flowing rests with the power engineer.

The engine builder carries the responsibility of producing a unit that has reliability built into its very heart. This means sound design, materials and workmanship, plus conservative rating. Performance of modern engines proves that the builders have done their job.

Thus it's up to the operator to get out of the engine all the reliability and efficiency built into it. This is always important; operating costs definitely reflect the quality of the maintenance job done. Now, more than ever, maintenance takes top rank. Many plants carry greater loads than ever before, and for longer hours; the cost of a shutdown in terms of lost production has never been so high.

At the same time, the maintenance job has never been so difficult. Repair parts and materials are scarce; skilled operators and mechanics are scarcer.

No longer can any power engineer depend on the "fix it when it breaks" system. War times require the kind of operation that avoids trouble-forming conditions, the regular inspection that spots little troubles before they get to be big ones, and the methodical, scheduled, preventive maintenance that permits the engineer to run the maintenance job instead of the maintenance job running the engineer. As a guide to all three of these jobs, POWER presents its 44th special section—"Diesel- and Gas-Engine Maintenance."

IN ANY PLANT, a good engineer can do a good maintenance job. Nevertheless, some plants are easier to operate and maintain effectively than others. Their designers have avoided layouts that handicap the engine and make it difficult to carry out even routine maintenance operations. They have provided the alarms and controls needed to protect valuable equipment, and the meters and instruments without which operators must work blindly.

Check your plant against the pointers that follow. If you find that some feature of plant layout or lack of proper equipment hampers your operation and maintenance work, do whatever you can about it immediately. If wartime restrictions prevent action now, make your plans to correct the condition when it again becomes possible to purchase material and equipment.

Plant layout conditions that handicap the engine include intake and exhaust systems with excessively long pipe runs and too many bends and fittings. The resulting extra pressure drop reduces air supply to the engine in one case and increases backpressure in the other. Both mean loss of capacity. Make sure that intake air enters the engine at the lowest possible temperature.

For trouble-free performance, provide a double-circuit cooling system, which tends to reduce or eliminate scale formation and consequent overheating troubles. Protect the engine with adequate strainers and filters on both fuel and lubricating systems. A reclaiming or purifying system for lubricating oil usually proves worthwhile investment, not only from the point of view of oil savings but from the angle of longer engine life and better performance.

Some wise engineer said "if you want something done, make it easy." This applies 100% to diesel- and gas-engine plants. Inspections will be made and parts will be cleaned and overhauled if getting at the engine and accessories is made easy by sensible layout. Likewise, make provision in plant design for taking units of equipment out of service without forcing a complete shutdown. For example, dividing the cooling-tower basin in two parts permits cleaning one with the other in use. Bypasses make it possible to remove valves for reconditioning without putting a line completely out of service.

Automatic controls and alarms protect the engine against human failures. Such devices do not take the place of skilled operators; they supplement them, back them up. The basic devices are the overspeed governor, controls or alarms for low lubricating-oil pressure, low cooling-water pressure and excessively high or low cooling-water temperature.

Meters and instruments, intelligently used, keep the operator's fingers right on the engine's pulse. Chief among these tools of the trade stand the exhaust pyrometer and the indicator, in one of its several forms. Without these, operation tends to fall to the level of guesswork. Backing up these devices come the pressure gages, thermometers and meters of all kinds that complete the installation.

Good plant layout makes operation easier; as outlined in following pages, good operation means less maintenance.

ACKNOWLEDGMENTS: For many of the data in this section we are indebted to the helpful literature of manufacturers and the published writings of leading engineers and operators. We regret that the nature of the treatment and lack of space prevent individual acknowledgment of sources

OPERATION

THE KEY TO GOOD OPERATION is regularity—establish sound procedures and stick to them. Follow a carefully worked out routine for even such apparently simple operations as starting and stopping the engine. Determine, from your own experience and from the engine builder's instructions, the various items that need regular attention during normal operation, and set up a procedure that insures attention.

The pointers below emphasize the important factors to be considered in starting, normal operation, and shutting down. Many will seem elementary to experienced engineers. However, this check list should prove useful as a reminder and as a guide to men new to internal-combustion work.

Adequate records, whether a simple log kept in the engineer's notebook or a carefully designed set of forms, play an invaluable role in plant operation. Keeping such records means that the operator must regularly check pressures, temperatures, load and other vital factors. Merely making a record is not enough, however. The record must be used.

OPERATING POINTERS

Starting the Engine

Follow the manufacturer's recommended procedure, paying particular attention to the following: Check for **mechanical interference** by barring the engine through at least one full cycle. If equipped with a starting valve on every cylinder, 4-cycle engines with six or more cylinders and 2-cycle units with four or more start from any crank position. **"Spot" other engines** by positioning crankshaft so that cylinders with starting valves receive air in proper order. Set crank of cylinder to get air first about 15 deg past top center. **Check camshaft position** to make sure valve timing is in phase. Engines cranked by battery or gasoline engine usually start from any crank position.

Make sure that **cooling system** is full of water and that there are no restrictions on free circulation. On engines with independently driven pumps or overhead tanks, establish flow before starting, to rid system of air.

Operate hand pump or turn engine over several times **to insure oil film** at bearings. With independently driven oil pumps, start flow before engine runs. Check hand-lubricated parts, grease and oil cups; operate mechanical lubricators by hand a few times.

Prime fuel lines and vent air. Make sure fuel reaches injection valve to insure quick starting. Check fuel supply; if fuel must be heated, start heating in time to bring fuel to proper temperature for start. Make sure that starting-air tanks or batteries are **fully charged.** Set governor or hand throttle to give about two-thirds of full fuel feed.

Immediately after starting, check **lube-oil pressure, cooling-water flow** and **fuel supply.** Watch entire engine to see if all parts function properly. If possible, run engine at light load until it reaches running temperature. Charge starting tanks or batteries.

Normal Operation

Inspect engines hourly, looking for leaks, listening for mechanical noises, checking temperatures by instruments or feel. Test emergency devices often.

Watch loading. No serious harm follows underloading but it is uneconomical. Overloading causes combustion troubles and overheating. Check ammeters regularly; low readings may conceal overload conditions. **Use exhaust pyrometer** to check cylinder load division. Low temperature may indicate lack of fuel, poor spray-nozzle action or low compression pressure, probably caused by blowby. High temperature may mean heavy cylinder loading, delayed combustion or scale in jackets. **Inspect pyrometer elements** regularly; if dirty they will read low.

Hold jacket-water temperature to range recommended by manufacturer; in absence of instructions set outlet temperature at 130–150 F (150 F for high-speed units). **Regulate jacket flow** to keep temperature rise to 10–20 F; this makes turbulence in water spaces, prevents local hot spots and cuts temperature difference between top and bottom of cylinder. **Excessively high outlet temperature** may break down protective oil films. **Low temperature** causes incomplete combustion and condensation on lower cylinder walls, a common cause of liner wear, particularly in gas engines.

Scale in jackets lead to overheating, which causes "growth" of cylinders and pistons, scoring, warping, cracking and burning. Scale also reduces rate of heat-transfer in heat exchangers. In addition to scale-forming salts found in most natural waters, impurities such as oil, mud, and animal or vegetable matter cause low heat transfer rates and overheating.

If raw water is used in jackets, keep temperature at or below 140 F and if water is high in scale-forming substances treat with zeolite or other approved methods. Best solution lies in use of **double-circuit or closed cooling system** in which only soft water circulates in jackets. To remove accumulated scale, clean with inhibited acid or a reliable commercial scale remover, following maker's instructions. **To prevent corrosion,** keep pH of water high (9 or over) and avoid entrance of air into system. Oxygen scavengers such as sodium sulphite may be added to neutralize oxygen that cannot be eliminated.

Keep lubricating system clean; renew filter and purifier elements regularly. Check oil conditions by securing analysis or replace oil on a regular schedule. **Keep oil at proper temperature** (not over 150 F). High temperature tends to increase leakage from crankcase and accelerates oxidation and sludging. Investigate any increase in crankcase temperature; it may indicate a hot bearing. **Inspect oil coolers regularly** for scale on water side and sludge coating on oil side; use inhibited acid on water side, Oakite on oil side (see POWER, June, 1941, pg 438).

Investigate immediately sudden **oil-pressure changes** which may signal a break in the system. Increased pressure usually means clogging; slow pressure fall indicates bearing or pump wear, and a sudden drop means a burned-out bearing. **Blue smoke** in exhaust means excessive oil; adjust oil pressure or rate of cylinder feed. Check for faulty piston rings or mechanical defects if oil feed is right.

Where possible, **check combustion conditions** by taking indicator cards weekly; if regular indication is impractical read exhaust temperatures regularly and plot fuel consumption against load. **Observe condition of exhaust** as a rough check on combustion.

Stopping the Engine

Except in emergencies, follow orderly procedure in stopping engine. Make sure that starting equipment is **fully charged.** Check all pressures and temperatures to see if they are normal. Take load off engine gradually. **Always stop engine by shutting off fuel.**

After engine stops, shut off lube-oil supply if it comes from an independent source. **Keep cooling water circulating** through jackets and oil or water through pistons for about 15 min. after shutdown. If pump is engine driven **run engine at no load** until temperature falls. This avoids excessive local temperatures.

DIESEL-GENERATOR OPERATING LOG

Engine Nos.____ Hp Rating:____ Kw Rating:____ Day ending midnight:____ Operator, 1st shift:____ Operator, 2nd shift:____ Operator, 3rd shift:____

	1 AM	2 AM	3 AM	4 AM	5 AM	6 AM	7 AM	8 AM	9 AM	10 AM	11 AM	12 N	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	8 PM	9 PM	10 PM	11 PM	12 M
Circulating Water System																								
Temp at engine inlet, F																								
Temp at outlet cyl 1, F																								
Temp at outlet cyl 2, F																								
Temp at outlet cyl 3, F																								
Temp at outlet cyl 4, F																								
Temp at outlet cyl 5, F																								
Temp at outlet cyl 6, F																								
Inlet and Exhaust System																								
Temp exhaust cyl 1, F																								
Temp exhaust cyl 2, F																								
Temp exhaust cyl 3, F																								
Temp exhaust cyl 4, F																								
Temp exhaust cyl 5, F																								
Temp exhaust cyl 6, F																								
Air pressure, starting, psi																								
Air pressure, 1st stage, psi																								
Air pressure, 2nd stage, psi																								
Air pressure, 3rd stage, psi																								
Lubrication System																								
Force-feed pressure, psi																								
Crankcase temp, F																								
Temp to centrifuge, F																								
Temp from cooler, F																								
Fuel-oil System																								
Temp at injection pump, F																								
Load data																								
Kwhr generated, gross																								
Volts, phase A																								
Volts, phase B																								
Volts, phase C																								
Amperes, phase A																								
Amperes, phase B																								
Amperes, phase C																								
Frequency, cycles																								
Power factor, %																								

			Electric	Fuel	Lube Oil
Unit on line at: M	Meter				
Unit off line at: M					
Total					

Peak load, 15 min:	Hr operation:
Load Factor, %:	Gross kwhr per gal:
Outside air temp, F:	Barometer, in. Hg:
Air temp at engine inlet, F:	Press. drop at filter, in H_2O:
Water meter reading:	Water used:
Supplies used:	
Repair parts used:	
Men on duty:	
Remarks:	

			Electric	Fuel	Lube Oil
Unit on line at: M	Meter				
Unit off line at: M					
Total					

Peak load, 15 min:	Hr operation:
Load Factor, %:	Gross kwhr per gal:
Outside air temp, F:	Barometer, in. Hg:
Air temp at engine inlet, F:	Press. drop at filter, in H_2O:
Water meter reading:	Water used:
Supplies used:	
Repair parts used:	
Men on duty:	
Remarks:	

			Electric	Fuel	Lube Oil
Unit on line at: M	Meter				
Unit off line at: M					
Total					

Peak load, 15 min:	Hr operation:
Load Factor, %:	Gross kwhr per gal:
Outside air temp, F:	Barometer, in. Hg:
Air temp at engine inlet, F:	Press. drop at filter, in H_2O:
Water meter reading:	Water used:
Supplies used:	
Repair parts used:	
Men on duty:	
Remarks:	

If it is a good record in the hands of a good engineer, it will prove its usefulness daily.

There are two kinds of records: *Operating* and *accounting*. The first presents a picture of engine conditions—cooling-water and exhaust temperatures, air pressure, lubricating oil pressures and temperatures, electrical and other load data. Study of such records is like feeling an engine's pulse and taking its temperature. It is in these records that the watchful engineer spots small troubles when they can be cured inexpensively rather than later when they may mean a serious breakdown or heavy repair expense.

Accounting records deal largely with what the plant produces in terms of kwhr, water pumped, tons of ice made, etc, and with what the plant consumes in terms of fuel and lube oil, operating labor, supplies, parts, etc. These are the records that spot inefficiencies and excessive costs. Combined with the operating records mentioned above and the maintenance records to be discussed later, they give the complete picture that the engineer must have for trouble-free low-cost performance.

The sample log sheet above shows one way to keep operating records. While essentially complete as to the *kind* of data to be set down and the frequency, the amount of detail required and the arrangement will vary from plant to plant. Note that the form provided covers *one* engine only; there would be a similar sheet for each unit in the plant. Most readings are taken on an hourly basis; other data is recorded once each shift.

A typical accounting-record sheet is made up in the form of a monthly report, with space for each unit in the plant. For each unit, daily entries show kwhr generated, hours of operation, fuel and lube-oil consumption. Station totals are entered for gross and net output, peak load, city-water and fuel-oil consumption, hours of maintenance labor and operation labor. Daily items are summarized in monthly entries for comparison with the same month of the past year.

TROUBLE-SHOOTING CHECK LIST O

Systematic operation practically eliminates unexpected and unexplained difficulties but even in the best plants trouble occurs once in a while. The check list presented here may prove helpful when trouble-shooting is needed.

ENGINE FAILS TO START

Not enough fuel; air in fuel line	Are tanks full and valves open? Make sure pumps and piping are primed and vented. Is transfer pump working? Are filters clean?
Water or dirt in fuel	Drain fuel system and tanks; clean tanks; prime and vent pumps and lines properly
Starting valves out of order	Make sure valve admits air just as piston passes top center. Does valve open fully? Check for starting-valve leakage or valve stuck open
Low compression	Inlet and exhaust valves may not seat properly. Look for stuck piston rings. Check position of compression release. Cylinder-head or valve-cage gaskets may leak
Cranking speed too low	Check starting-air pressure or battery voltage. Bearings may be too tight or cylinder walls need lubrication. Check for low compression, as above. Warming jacket water, intake air, lube oil, or engine itself, may help
Fuel injection improperly timed	Make sure fuel injection occurs at or just before top center

FAILS TO COME UP TO SPEED

Not enough fuel	Fuel may require heating for free flow. Check governor or throttle controls. On air-injection units, check injection pressure. There may be air or water in fuel
Fuel nozzles dirty or clogged	Inspect nozzles, clean them or replace with spares if necessary
Injection-pump valves leak	Check valve condition; regrind or replace valve and seat assemblies if necessary
Low compression	Check compression as described above
Engine overloaded	If meters indicate overload, drop load enough to insure normal operation. Make sure meters read correctly
Too much friction	Bearings may be too tight. Lubrication may be inadequate. Look for overheating

CYLINDERS MISS

One or more cylinders miss	Locate cylinder at fault by open each fuel line in turn or putting in vidual pumps out of action. If cylin is firing, speed drops when fuel is s off; if speed stays same, faulty cylin is spotted. Missing cylinder can a be detected by opening exhaust try c or indicator connection for each cy der
Valves at fault	If valves stick, put mixture of keros and thin lube oil on stems until ba source of trouble can be remedied. L for broken valve and replace if fo Check for leaky valves and regrind
Lack of fuel	If fuel valve is stuck, remove and cl Check fuel-pump valves for stick May be air in fuel lines or pump; w or dirt in fuel. Check for plugged fil or strainers
Low compression	If one or more cylinders fail to until engine has run for some time, l for leaky or sticking valve, stuck ri Check for head or jacket leaks; s amount of water in cylinder may p vent ignition until heat evapor water
Erratic missing; all cylinders	Check for conditions affecting all cy ders—water or dirt in fuel, plugged filters, fuel of poor burning quality
Two-cycle engines	Check scavenging-air pressure, insp scavenging-air valves, and air-suct valves to crankcase in crankcase-sc enged engines. Look for carbon depo on exhaust ports, which might ca back pressure

FAILS TO CARRY LOAD

Too much friction	Possible causes include: inadequate l rication, reduction in heat tran caused by jacket scale; bearings tight, piston seizure. Stop engine, over and try to find which is ca Check for stuck rings; free them found.
Lack of air	Check pressure drop in air filters clean if required. Look for any o restrictions in air-intake system. the effect of altitude sufficiently allo for in determining the rating of engine?

ISTOR OPERATING ENGINEERS

cessive kpressure	Inspect exhaust piping, mufflers, and waste-heat boilers for flow restrictions such as might be caused by carbon deposits. Check for pulsations that might cause backflow of exhaust gas
compression	See pointers under this heading above
k of fuel	See pointers under this heading above
gine overloaded	Defective or inaccurate meters may conceal actual overload. If overload actually exists, drop load to normal

ENGINE STOPS

k of fuel	See pointers under this heading above
rication ure	Look for break in piping, or pump failure. Make sure system is filled to proper level
chanical erference	Crank engine over to see if it is free. Check bearings, piston. If piston seizure stops engine, get piston out of cylinder immediately and inspect piston and liner. Mild scoring can be corrected with an oil stone. Severe scoring means reboring or replacement of parts
gine overloaded	See pointers under this heading above
compression	See pointers under this heading above

ENGINE KNOCKS

zle valves fault	If spray-nozzle valves stick, clean and lubricate. Look for broken valve spring and replace
l timing wrong	If rate of combustion-pressure rise is too rapid, engine will knock. Fuel knocks are sharp pings. Indicate engine; check maximum combustion pressure and study shape of card. Check fuel-injection-pump timing or fuel-valve timing
t or exhaust e sticking	Lubricate stem with mixture of kerosene and thin lube oil. If condition is not severe, turning stem by hand may free valve
roper fuel; or water uel	Fuel with poor ignition qualities may cause erratic knocking in one or more cylinders, or more or less steady knocking in all. Erratic knocking may indicate water or dirt in fuel or presence of air in fuel lines

MECHANICAL NOISES

Pounding	Check for loose crankpin bearing by "jacking" (see page 89). Check for excessive clearance in wristpin bearing by putting crank on bottom center and prying up on piston. Piston may tip in cylinder; check clearance and, if excessive, fit new liner or piston
Knocking	If head gasket is of wrong thickness, bearings are worn, or there are too many compression shims, piston may strike inlet and exhaust valves. Excessive valve-tappet clearance may cause knocking. Check entire valve mechanism for looseness or play

ENGINE OVERHEATS

Engine overloaded	See pointers under this heading above
Poor cooling	Check cooling-water temperature and rate of flow. Look for scale, mud or other obstructions in jackets and water spaces of heads. Inspect heat exchangers, cooling towers, radiators
Poor combustion	Indicate engine and study cards for signs of combustion irregularities
Lubrication inadequate	Lube-oil pressure may be too low; check relief valve for sticking or leakage. Inspect and clean strainers and filters. Loose or burned out bearing may cause loss of pressure. Check piping for leaks. Lubricating oil may not be suited to engine
Hot bearings	If bearings receive proper oil supply, check condition of bearings, looking for tightness, poor fit or misalignment causing binding

SMOKY EXHAUST

Engine overloaded	See pointers under this heading above
Poor combustion	Check grade of fuel used. Indicate engine and study cards for combustion irregularities. Watch action of entire fuel-injection system. Check injection pressure, in air-injection engines. Make sure air supply is adequate. Check for fouled nozzles
Excessive lubrication	Blue smoke in exhaust often indicates excessive lubrication. Check oil pressure and rate of cylinder feed. If oil feed is right, check for faulty piston rings or other defects

MAINTENANCE

SUCCESSFUL DIESEL and gas-engine maintenance depends on skillful planning. In the well-run plant, unexpected maintenance is rare. Regular inspection detects the progress of normal wear, spots troubles before they become serious. Scheduled maintenance brings parts back to top-notch condition to give additional hours and months of service.

Setting up a thorough inspection and maintenance schedule forms the first step in organizing the maintenance job. Only someone familiar with a given plant can do this; the schedule must make allowance for type and make of engines installed, condition of load, nature of fuel and other local factors. The typical schedule below is intended to serve only as a sort of outline for the schedule that the individual engineer will make up for the various equipment in his own plant.

In working out a schedule, consider both engines and accessories. *Operating hours* forms the basis for timing maintenance operations on engines that run regularly. For standby units and for accessory equipment, piping, etc, it is customary to base schedules on *elapsed time*. Start by deciding, on the basis of the engine builder's recommendations and on experience, the period to be allowed between major overhauls. This usually runs in the neighborhood of 8000-10,000 hr; for convenience, 8000 hr has been used in the sample schedule below. This represents about one to two years' time, depending on load factor. It is customary to specify annual overhaul for accessories and plant piping.

TYPICAL INSPECTION AND MAINTENA

	ROUTINE OPERATIONS	QUARTERLY, OR EVERY 2000 HR	SEMI-ANNUALLY OR EVERY 4000 HR
VALVE MECHANISM	Check lubrication and adjustment hourly		Remove and inspect for wear on mo ing parts
CAMSHAFT AND DRIVE			Check and adjust camshaft gears, cha
VALVES	Check operation hourly. Inspect monthly	Inspect and grind exhaust valves	Inspect and regrind inlet and exhau valves. Check spring length, tensio
INJECTION SYSTEM	Check spray-valve tightness each time engine shuts down. Indicate engine weekly	Inspect and clean nozzles (oftener if needed)	Clean and test nozzles. Clean and gri fuel-pump valves, inspect plungers
STARTING SYSTEM	Check for leaky starting valves, blow air tanks, check safety valves — daily	Drain air lines to remove trapped moisture	Clean and grind air valves. Check pre sure gages. Inspect piping for lea
LUBRICATION SYSTEM	Check mechanical lubricators; oil all hand-lubricated parts hourly. Clean strainers daily. Check filters, centrifuges weekly	Examine piping for loose joints, leaks. Clean heat exchgrs, dirty-oil tanks	Examine piping; clean heat exchan ers, dirty- and clean-oil tanks. Flu crankcase. Inspect lube-oil pumps
PISTONS			Pull pistons and clean. Inspect pisto and rings
CYLINDERS AND HEADS	Blow out indicator connections daily	Examine and clean cylinder heads	Examine and clean heads. Inspect an wash jackets
WRISTPIN AND CRANKPIN BEARINGS	Open handholes, look and smell for hot bearings; listen for knocks		Check and adjust
MAIN BEARINGS, CRANKSHAFT			Check main-bearing alignment
GOVERNOR, ALARMS AND INSTRUMENTS	Check operation of alarms daily. Check pressure-gage lines and clean exposed temperature-indicating elements monthly		Calibrate instruments. Check press gages with deadweight tester
INTAKE, EXHAUST	Clean filters as required. Clean carbon from exhaust ports and piping, monthly		
COOLING SYSTEM		Inspect piping, valves. Clean heat exchangers	Drain cooling-tower basin and clean
FUEL-OIL SYSTEM	Clean strainers daily. Check filters and centrifuges, weekly		Drain water and sediment. Check he ing coils for leaks
ELECTRICAL EQUIPMENT	Inspect all brushes each shift. Clean generators, exciters, motors, switchboards and commutators monthly	Clean, adjust and calibrate watthour meters	Clean and calibrate indicating ins ments and relays. Inspect cir breakers and clean

Thus in our hypothetical plant we plan on a complete dismantled inspection, followed by adjustment and reconditioning, every 8000 hr for the engine and one a year for the rest of the plant. The actual work to be done should be put in writing in the form of complete overhaul instructions. Besides being educational, such a work list serves an essential purpose in guiding the men doing the job, insuring that nothing is overlooked. Such a step-by-step outline of overhaul procedure helps in getting the work done in the most efficient manner and is particularly valuable when new or untrained men must be used on the job.

Some maintenance operations must be carried out one or more times between overhauls, either in full or in less complete form. For example, it may be necessary to grind exhaust valves every 2000 hr and inlet valves half as often, or every 4000 hr. Usually, enough of these operations are required at the halfway mark (4000 hr in this case) to constitute a "semi-overhaul" or "half-time overhaul." This involves partial dismantling of equipment and as full an inspection as can be made under these conditions.

Virtually all maintenance operations requiring any substantial dismantling or reconditioning work will fall at quarter-time, half-time, or full overhaul periods. However, where operating conditions are severe, operations like exhaust-valve grinding and fuel-nozzle inspection and cleaning may be required more often.

In addition to these items that may be classed definitely as maintenance, there are many others which require little or no dismantling or mechanical work. Examples are routine inspection of the engine while it is in operation, periodic testing of safety and relief valves, and cleaning operations. These are, nevertheless, an important part of maintenance and thus are included in the schedule below, along with tentative suggestions as to timing.

Remember that the schedule at the left is designed to serve only as an example. It does not pretend to cover all types of equipment nor can its suggestions as to time intervals between operations be followed directly in any individual plant. It does serve, however, to indicate the general way in which a maintenance schedule may be set up and gives some idea of its scope. Make your own to fit your plant, and don't be afraid to make it detailed—the more detail, the more useful the schedule will be.

In actual application, the schedule only *guides* timing of maintenance operations. Such work must be timed to fit plant conditions and to take advantage of shutdown or light-load periods. In plants operating several engines, the same general schedule applies on all similar engines, but actual work is staggered to spread the labor and to avoid having more than one machine out at a time. Many engineers even stagger such items as valve grinding and piston pulling, doing one cylinder at a time. With a little planning, work can be arranged on a cylinder-at-a-time basis so that all parts receive attention at specified intervals and there is no great loss of operating time at any one shutdown. Such a scheme can be made even more efficient by providing a supply of spare parts, such as fuel nozzles and valve-cage assemblies, which can be installed in place of the part needing maintenance.

HEDULE

ANNUALLY, OR EVERY 8,000 HR
Remove and inspect for flat spots and wear on moving parts. Check roller clearance
Inspect camshaft and drive. Adjust bearing clearance, gears, chain. Examine cams for tightness, wear
Inspect and grind valves. Check spring length and tension. Inspect stem bushings, guides. Adjust valve timing
Clean and test nozzles. Check all moving parts for wear and adjustment. Check and recondition all pump and check valves
Dismantle and recondition air valves. Overhaul air compressor. Check piping. Inspect and clean air tanks. Check pressure gages
Flush crankcase. Inspect lube-oil pumps and recondition. Renew packing. Dismantle, clean and repair relief or bypass valves. Inspect and clean oil piping, tanks
Pull pistons, remove rings, check condition. Clean and inspect piston, oil-cooling pipe. Check ring end clearance, side clearance
Inspect and clean heads and jackets. Measure liner diameter. Check gasket annealing
Remove and inspect piston pins. Check bearing, and alignment of wristpin and piston. Check bolt elongation. Remove and inspect bolts and bearings. Replace and adjust bearings. Insert compression shims
Remove caps, inspect lining and journals. Take bridge-gage readings. Remove and inspect lower shells. Replace and adjust bearing clearance. Clean oil passages. Examine shaft for cracks. Measure distance between crankwebs. Check journal level
Calibrate instruments. Check pressure gages. Dismantle and overhaul governor; check all moving parts for wear and adjustment
Inspect and clean carbon from exhaust ports, piping, mufflers, waste-heat boilers
Inspect and clean entire system. Remove scale. Inspect and overhaul valves, pumps
Inspect and clean oil piping, tanks, etc. Overhaul pumps. Inspect and repair filters and strainers. Check meters or gaging devices
Clean, adjust and calibrate all meters and relays. Clean, inspect and overhaul all rotating machinery and switchgear

Maintenance Records

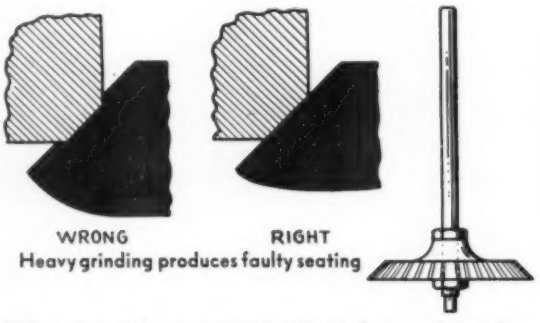
Some form of maintenance schedule is necessary in every plant, small or large. Equally important is a record of maintenance operations. Just how these records are kept depends on plant size, number of engines, etc. As a minimum, the operator should set down notes on condition of engine parts as revealed by inspections and measurements, and a brief report of any reconditioning operations undertaken. In addition, the record should include a report on any parts that fail in service and on the subsequent repair.

In a small plant, the operator can jot these notes on the daily log sheet or in the log book. Larger plants use special forms. In one case, a single large form covers each engine, providing space for a complete record of conditions found on each general inspection. This form is supplemented by another which is filled out whenever a part fails in service, showing what part was involved, what happened to it, how it was repaired, what was done to prevent recurrence, and labor and material cost for repairs.

In other plants, operators maintain a card record for each part of each engine, showing date installed, condition at each inspection, and maintenance operations performed.

Whatever form the record may take, it provides invaluable facts, showing a progressive picture of mechanical condition

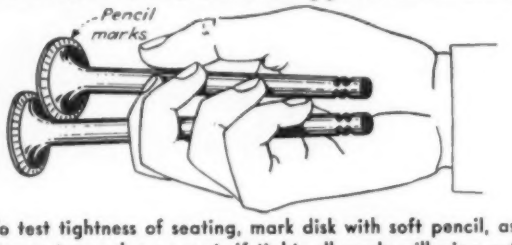
HINTS ON VALVE UPKEEP



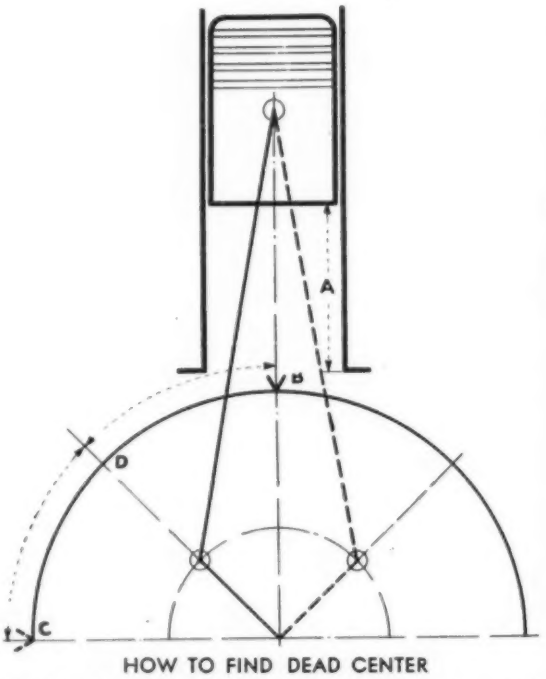
WRONG RIGHT

Heavy grinding produces faulty seating

Reface seats with rose reamer having guide same size as stem



To test tightness of seating, mark disk with soft pencil, as shown; turn valve on seat; if tight, all marks will wipe out



HOW TO FIND DEAD CENTER

To find dead center for any given crank throw, turn shaft to put piston about one-third of the way along the stroke. Measure distance *A* accurately. This can be taken from bottom of piston, as shown, or from some point on the crosshead, to the bottom of the cylinder liner. Secure a pointer *B* to some part of the engine frame. Mark flywheel rim opposite it. Turn shaft to put piston in exactly the same position as before, with crank on the other side of dead center. Mark flywheel rim again, opposite pointer, at *C*. Divide accurately the distance between *B* and *C* to find the dead-center point *D*.

Measure carefully the circumference of the wheel. Divide by 360 to mark the rim in degrees. By reference to the engine builder's timing diagram, the valve events can be marked on the wheel rim for future reference. Repeat the procedure for each crank throw and properly identify the rim markings so that there will be no confusion.

and wear and giving data on part life. These facts permit anticipation of renewals and replacements, provide a basis for building a spare-parts supply, and furnish information which checks the adequacy of the inspection and maintenance program and the faithfulness with which it is carried out. Finally, detailed maintenance records reveal weaknesses in equipment or layout which can often be corrected.

Maintenance Operations

The schedule on page 84 serves as an outline of the various maintenance operations; the text and sketches on this and the next few pages amplify and give practical pointers on some of the general groups of operations.

Valves: As part of the regular hourly routine, the operator should observe valve action, looking particularly for signs of sticking. Lubricate sticking stems with a mixture of kerosene and thin lube oil and remember that too much lubrication is worse than too little. It is sometimes considered good practice to give exhaust-valve stems a half turn each hour to prevent burning on one side.

Inlet, exhaust and starting valves need regular inspection and reconditioning. The interval between inspections should be about half as long for exhaust valves as for the less severely loaded inlet and starting valves. If inspection takes place at frequent intervals, reconditioning will usually involve only grinding the valve to the seat. Seats should look polished but light pitting doesn't usually interfere with tightness and proper operation.

When valves are caged, it is a simple matter to remove the entire assembly for grinding. If a spare assembly is available, it can be installed and the removed valve can be ground at convenience. Valves that seat in the head or in seat-ring inserts can be ground most conveniently if a suitable stand is provided to hold the cylinder head.

Grind lightly; heavy grinding produces a faulty seat, as shown in the sketch at the left. Make sure that the stem guides the valve properly and use only a small amount of fine grinding compound. Grind with a back and forth motion; lift the valve clear and turn to a new spot frequently. Test tightness by marking valve with a soft pencil, as shown in the sketch, and turn the stem. If the seat is good, all the marks will be wiped out.

Heavily worn or pitted seats and disks require refacing before grinding. Reface the disk in a lathe or against a grinding wheel, using a suitable guide or holder. Most seat refacing is done with a rose reamer of the general type illustrated; the guide is the same size as the valve stem. Seats in valve cages can also be refaced in a lathe.

At each inspection, check valve springs for length, tension, and soundness. Throwing the spring down hard on the floor or hanging it up and striking it detects cracks. Also inspect valve-stem bushings and guides.

Reassemble valves carefully. Use new gaskets or carefully annealed used copper gaskets. Tighten hold-down bolts evenly to avoid distortion; do this preferably when the engine is cold. Make sure valve will seat in any position; a bent stem will cause it to hang up in one spot but not another.

Valve Timing: After overhaul, or when made necessary by valve mechanism wear, valves must be retimed so that they open and close in proper relation to crank angle. On most engines, flywheel marks show dead center and valve events; if not, dead center must be found as shown in the sketch.

With this done, and with engine builder's instructions as to proper angles, you are ready to check timing.

Always turn flywheel in direction of rotation. If you turn wheel past mark, make a full turn to bring it around again. Reversing rotation introduces timing-gear backlash. Use feelers to measure tappet and cam-roller clearance.

Checking valve timing accurately involves use of dial indicator, mounted securely on some fixed engine part with indicating finger resting on the valve stem to include all lost motion. Turn flywheel in direction of rotation and watch indicator dial for first signs of lift. This should occur at recommended angle. If it does not, continue rotation until correct point is reached.

Check clearances, then unmesh timing gears or chain and turn camshaft until dial gage shows valve starting to lift. Engage timing gears or chain to nearest tooth or sprocket. Follow same procedure to check valve seating.

This method can be used on any valve but its accuracy makes it particularly suitable for timing fuel valves. For ordinary checking on inlet, exhaust and starting valves, it is enough to note when all clearance is taken up and it is no longer possible to turn cam rollers with the fingers, or when the stem can or cannot be rotated by hand.

Injection System: Regular inspection and cleaning of fuel nozzles and spray valves is important; depending on the fuel, the interval may be from once a month to about every 2000 hr. In addition, use an approved testing setup to check injection-valve tightness, to determine pressure at which valve lifts and to view the spray pattern. Replace defective nozzles promptly. Check spray valves for tightness each time the engine is shut down.

As a check on combustion conditions and compression, use some form of indicator regularly; once a week if possible. This will show up combustion irregularities which may be traced to the fuel-injection system, the valves, or other causes. If proper compression pressure is not obtained, adjust by adding shims under connecting-rod foot.

Other parts of the fuel-injection system that require attention are timing and wear of injection-pump or spray-valve cams. Keep pump valves absolutely tight by regular grinding. At the full overhaul, all of the above need checking; in addition, inspect all moving parts for wear or lack of adjustment. Dismantle all pumps and recondition; also recondition all pump and check valves. After reassembling, make sure that timing is correct and that all pumps measure exactly the same quantity of fuel to each cylinder.

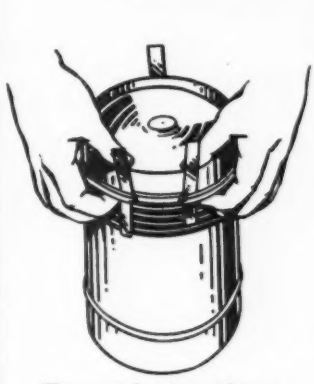
Pistons and Rings: In many plants, operators pull pistons for inspection at least once between full overhauls. The amount of work done depends largely on the condition of piston and rings after a thorough cleaning to reveal surface defects. The pointers that follow apply mainly to a full overhaul job but any or all of the operations may be required at the half-time piston pulling.

Before removing rings from piston, check the general condition, looking for evidences of blowby. Slip thin metal strips under the rings, as shown in sketch at right, to aid removal, or use an expander as shown below. Avoid opening rings any more than is absolutely necessary. To loosen stuck rings heat piston slightly or soak in kerosene.

Clean and inspect piston inside and out for cracks, scores or other defects. A uniform oil film, without bright spots or blackened streaks, indicates good fit. Check piston straightness with an accurate straightedge, and caliper for roundness.

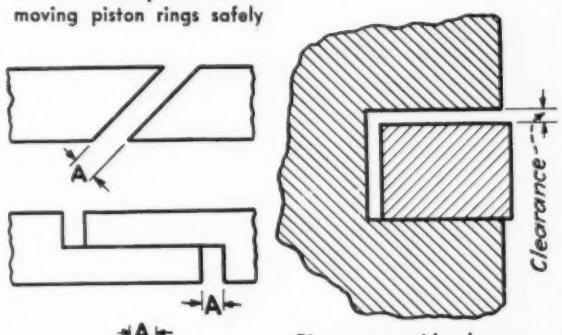
Remove piston pins and examine condition. Measure pis-

PISTON-RING POINTERS



Checking ring-groove depth by means of a straight edge

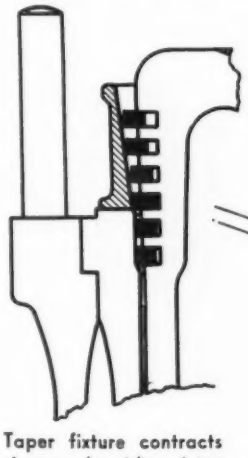
Thin metal strips aid in removing piston rings safely



Ring-groove side clearance must meet specifications

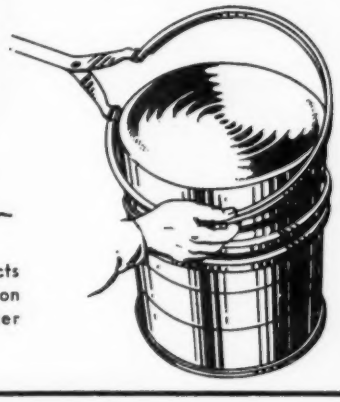
Sketch shows end clearance on several types of piston rings; measure gap opening *A* with feelers, when ring is in cylinder

Roll ring around in groove to check depth, side clearance; rings can be ground down on a surface plate or glass sheet



Taper fixture contracts rings and guides piston assembly into cylinder

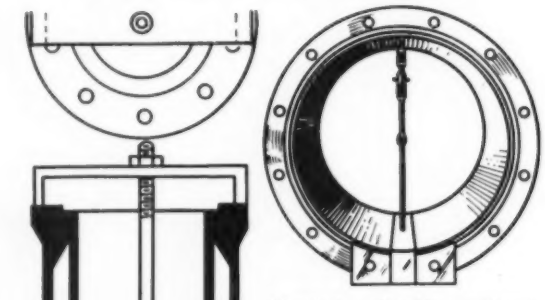
Using a piston-ring expander offers a safe and convenient method of ring installation



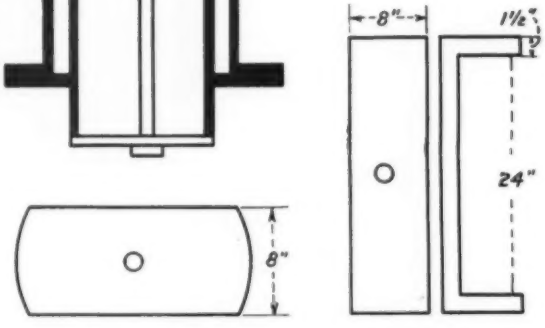
ton at pin boss, noting dimensions both parallel and perpendicular to pin. Install pin. Check condition of ring grooves, looking particularly for shoulders. Turn badly worn grooves in a lathe, for use with wider rings, or weld-in a liner to restore groove dimensions.

Inspect rings for excessive wear, scratches, or other defects. Test rings for fit by placing in lower part of open cylinder and examining closely to check fit in bore. With ring still in cylinder, measure end clearance with feelers. Discard any ring that does not fit or that shows more than 0.005 in. end clearance per inch of diameter. Checking may be simplified by making a ring gage of proper diameter into which rings can be inserted for testing.

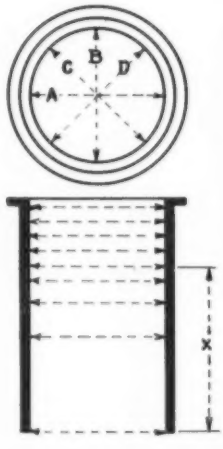
MEASURING AND LOGGING CYLINDER-LINER WEAR



Handy template fits over head studs; insures taking measurements at same place each time



Above: Simple jacking device for pulling cylinder liners
Below: Recommended locations for liner-wear measurements



LOG OF LINER WEAR

ENGINE NO. _____

CYLINDER NO. ____ DATE ____

Position	A	B	C	D
Top ring				
2nd ring				
3rd ring				
4th ring				
5th ring				
0.1 X				
0.25 X				
0.6 X				
Bottom				

As shown in sketch, roll rings around in groove, to be sure groove is deeper than radial thickness of ring and that proper side clearance is obtained. If ring fits tight or carries rough edges or burrs, it may be ground on a surface plate or sheet of glass, as shown in sketch on page 87. Install rings, using metal strips or expander. Turn rings in grooves to check for tight spots and leave rings with joints staggered. Make sure that special rings are installed right side up; sharp edge of scraper rings points away from combustion chamber.

If piston is oil-cooled, clean oil piping. Make sure that telescoping tubes or swinging pipes align properly. Check oil drain holes and channels back of scraper rings to make sure they are clear. Oil liner, piston and rings before inserting piston assembly in cylinder. Use a jig with tapered bore, as shown in sketch on page 87, to contract rings as piston slides into cylinder bore.

Cylinders and Liners: Examine liner or cylinder bore for scratches or cracks, which may occur around the top edge. Make sure there is no shoulder at the end of the piston-ring travel. Check cylinder-lubrication connections for signs of leakage. On 2-cycle engines, make sure that exhaust-port-bridges are adequately undercut. This can be done with a straightedge and feeler gage.

Measure cylinder liners. Practice varies in this respect; the diagram and form for logging the measurements shown in the sketch at the left indicates what might be considered ideal practice. If a less comprehensive record will do, eliminate measurements at the quarter points and make only three measurements vertically: at the top, about a third of the way down and at the bottom. The sketch also shows a handy template for insuring uniform measurements.

A jacking device for removing worn liners is also shown. First drain the jacket, then break lubricating connections. After pulling the liner, clean top seating surfaces carefully and lubricate with graphite or other material that will not harm the rubber. Press liner firmly in place and check for roundness and fit; watch particularly lower water joint where rubber rings may squeeze and distort bore. Make up lubricating connections, fill jackets, and test for tightness at double working pressure.

When replacing cylinder heads, see that all contact surfaces are clean and that copper gaskets are annealed. Tighten head bolts gradually and evenly; improper tightening is a common cause of cylinder-head cracks.

Connecting-rod Assembly: When the piston is pulled, the connecting rod comes with it, the crankpin bearing having been disconnected. If this is done at the half-time overhaul, and no extensive work is needed on the piston, wrist-pin-bearing clearance may be checked roughly by hanging the piston and rod assembly and swinging the rod by hand. The rod should fall to a vertical position after being swung to one side, but not quickly. When rod is swung, piston should not tip; if it does there is not enough clearance.

Alignment of piston and rod assembly may be checked in the engine without dismantling by the method shown in the sketch at the right. Secure the crankpin bearing, put piston on bottom center and measure clearance from cylinder walls with feelers. Take measurements on both sides of piston, at top and bottom, along length of engine. Then put piston on top center and repeat. Tabulate measurements. If readings are the same after making allowance for cylinder-liner wear or piston taper, alignment is correct. If there is a difference, it may be necessary to turn the piston and rod around one-half turn in the cylinder or to disconnect the crankpin bear-

ings and turn rod and piston around on them. Make new readings and compare with each other and original readings. These measurements also serve to show clearance of piston in cylinder.

To make a rough check of crankpin-bearing clearance, insert a jack beneath it and lift it and drop it to see how much movement there is. A more accurate method, shown in the sketch, involves clamping a dial indicator to the connecting rod with the needle resting on the crank web. Use a jack or chain block to take up the bearing slack and read indicator to measure clearance. Be sure not to move the shaft.

When the engine is completely overhauled, alignment of connecting-rod assembly and bearing clearances may be determined more accurately. Procedure for checking a rod with marine bearings at both ends was fully described in POWER, April, 1942, pages 99-101. Referring to the sketches on page 90, put the bearing half on a surface plate and check with feelers for warp, rough spots, or uneven surfaces. When bearing sets flat on plate, check level of shim surface. Put a dummy pin in position and measure from each end of pin to surface plate, using a dial gage. If measurements are the same, bearing bore parallels rod-foot pad. At the same time, use of blueing on the mandrel will check condition of half-bearing surface.

To check if surfaces of both connecting-rod feet are smooth and true, set rod in vertical position on surface plate and check for openings between plate and foot face. Follow same procedure on other end of rod. Now lay rod in horizontal position and level crank-end foot; piston-end foot should also be level. If there is any doubt about symmetry of bearing-bolt holes, insert fitted bolts and make level readings from top of them. Correct any misalignment before going further.

Place rod in vertical position again and check distance from surface plate to a straightedge laid across piston-foot. Distances on both sides should be the same. Assemble rod and bearings, leaving out shims. Clamp dummy pins in place and level crankpin dummy. If bearings have been bored accurately, piston-pin mandrel will be level also. With inside micrometers, measure distance between dummy pins on each side of rod. Remove mandrels and assemble piston-pin bearings with proper clearance.

Assemble piston and connecting rod and lower into place. Assuming that the crankpin bearing has already been inspected and fitted, it only needs adjustment to the crankpin. Assemble bearing with original shims. Place lead wires over the top half of the journal; usually two to four wires are enough. Lead wire should be soft and not more than twice normal clearance; 3-amp fuse wire serves well. Install cap and tighten bearing bolts. Remove wires and "mike" wires to find maximum thickness which represents existing clearance. Reduce shim thickness as required and reassemble bearing.

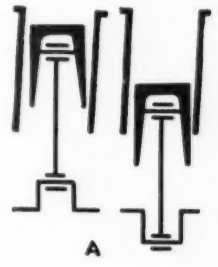
Connecting-rod Bolts: Perhaps the most satisfactory method of tightening these important bolts is by accurate measurement. First assemble the bearing in the usual manner. Run the nuts down hand tight. Measure length of each bolt with a micrometer. Now tighten bolts until further measurements indicate a pre-determined amount of elongation. Proper elongation varies with size and type of engine and depends on length and cross-section of bolt, inertia forces, and allowable unit stress.

To facilitate tightening of bolts by this method, provide them with buttonhead studs on each end for measuring anvils. A specially designed micrometer with shallow frame, as shown in the sketch on page 90, also helps to make the job easier and increases the accuracy of measurement.

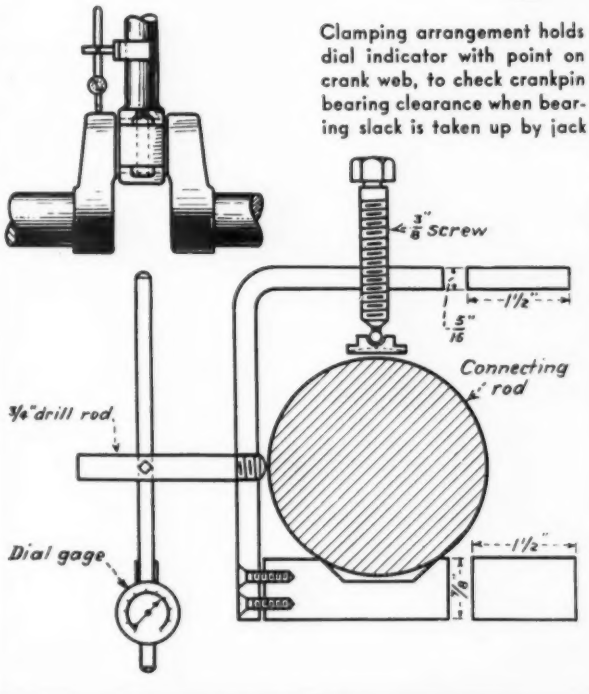
Some engineers recommend replacing connecting-rod bolts after a given number of hours of operation. According to modern theories of fatigue failure, if the working stress is kept below the endurance limit the bolt should last indefinitely. Thus, if a bolt operates for a year or two without failure, it is good evidence that it will not fail from fatigue and unless it has been abused or shows signs of damage, it may be safely reinstalled. Most bolt failures result from overtightening or uneven stress caused by eccentric loading induced by lack of parallelism between the faces on which the nut and the head seat. While the bearing is dismantled, examine bolts carefully for signs of damage.

CHECKING CONNECTING-ROD ASSEMBLY IN THE ENGINE

Measuring clearance on either side of piston, as described in text, detects misalignments like those sketched: (A) cylinder bore not perpendicular to crankpin; (B) piston and connecting-rod assembly out of line; (C) crankpin not perpendicular to cylinder bore



Clamping arrangement holds dial indicator with point on crank web, to check crankpin bearing clearance when bearing slack is taken up by jack



Main Bearings, Crankshaft: At any time, a crankshaft is an expensive item to replace; today such large forgings are extremely difficult to obtain. Thus the importance of checking crankshaft and main-bearing alignment cannot be over-emphasized.

Alignment can be checked without dismantling bearings by use of a strain gage. Make sure the shaft is down in its adjacent bearings by using a jack between the web and some member of the structure above it. Measure between the crank-webs at each 90 deg of shaft rotation. Do this for each pair of webs and compare readings, which should be within about 0.002 in. of each other.

At the time of complete overhaul, a more comprehensive check for alignment can be made. Remove each main bearing cap and check condition of lining. In the same way, inspect each lower shell, replacing those required for shaft support. Look for such mechanical defects as loose babbitt, cracks and evidence of wear. Surface discoloration does not necessarily indicate corrosion and may often be removed by simple cleaning procedures. Remember that bearing failure progresses uniformly; if after 1000 hr of operation 2% of the surface shows cracks, after 2000 hr 4% will show cracks. A bearing may be considered satisfactory until approximately 20% of the surface is covered with cracks.

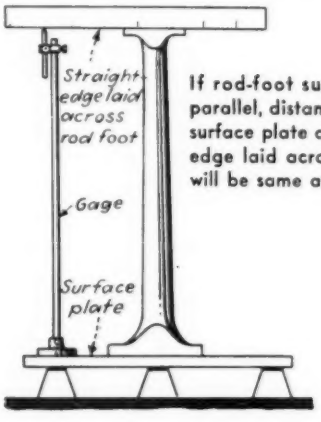
Suspend the shaft on two lower bearing shells, locating them so that the shaft will be balanced. Inspect shaft carefully for defects, injuries, or wear. Paint all suspicious parts with a mixture of chalk and alcohol. When shaft is rotated, any cracks present will give up oil which will discolor the chalk. If shaft proves difficult to rotate, bump with a wooden ram to cause vibration and release oil. Check each crankweb and journal for scores, rough spots or undue wear. With calipers and micrometers, determine amount of out-of-round and taper. Attention should be given to truing up the pin if out-of-round shows as much as 0.001 to 0.0015 in. per inch of shaft diameter.

Checking shaft for deformation can be simplified if enough dial gages are available to place one over each suspended journal. Fix them securely with points resting on respective journal tops. Set all gages to zero and revolve shaft slowly several times, watching for any appreciable deflection. Then set No. 1 crankpin on top center, reset all gages and revolve shaft slowly. Stop at each quarter position of No. 1 crankpin and read all gages. If there is no evidence of deformation, rotate shaft again and take a set of check readings.

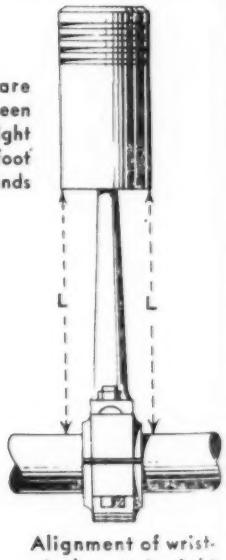
If gage readings indicate a kink in shaft, rotate shaft slowly to find position of No. 1 crankpin which causes affected gages to show maximum readings. This puts bend in extreme top or bottom position and angle between No. 1 crankpin and top center can be measured with a protractor. Again rotate shaft slowly, stopping to read gages at 90, 180 and 270 deg past extreme top position of bend. Repeat until consistent readings are secured.

The sketch (pg 91) shows a method of recording dial-gage readings. Each circle represents a journal; location of readings on circles indicates position of No. 1 crankpin when reading was taken. In case shown, extreme deformation occurs when No. 1 crankpin is 45 deg past top center. Readings

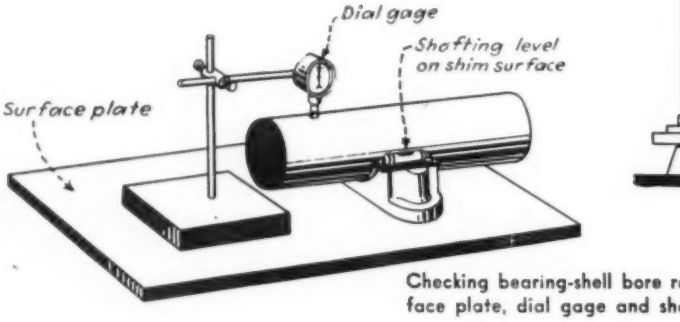
HOW TO DETERMINE CONNECTING-ROD-ASSEMBLY ALIGNMENT



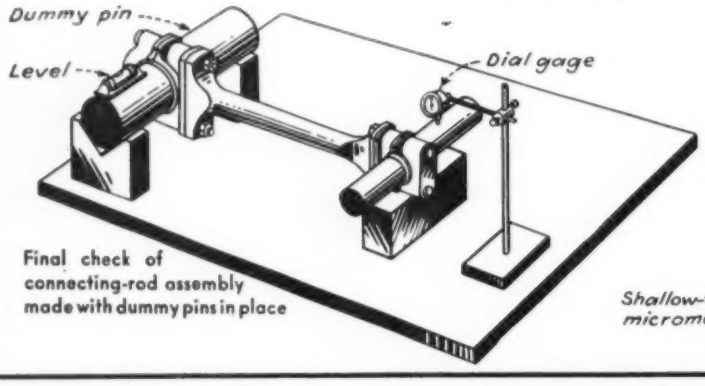
If rod-foot surfaces are parallel, distance between surface plate and straight edge laid across rod foot will be same at both ends



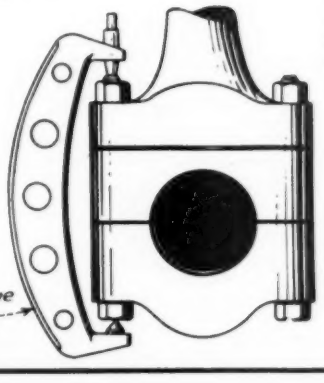
Alignment of wrist-pin bosses is right if distances *L* are found to be equal



Checking bearing-shell bore requires surface plate, dial gage and shafting level



Final check of connecting-rod assembly made with dummy pins in place



Special shallow-frame micrometer facilitates measuring

taken along shaft at this point can be plotted; distance between dial-gage positions forms the horizontal scale.

To check alignment of bearings, replace all lower bearing shells and lubricate each journal. Necessary equipment includes a bridge gage, a strain gage, and two jacks to hold the shaft down in the bearing shell. It is desirable, but not necessary, to take bridge-gage readings and measure crank-web deflection at the same time. Place No. 1 crankpin in top position and install strain gage near main-journal centerline. Before moving shaft, take a bridge-gage reading of the journal on either side of the crankthrow being checked. Rotate shaft in direction of normal rotation, stopping at each quarter point to record bridge- and strain-gage readings. Repeat this procedure, using the jacks to press the shaft down solidly in main-bearing shells on either side of the crankthrow. There should not be more than 0.002 in. difference in the bridge-gage readings of either journal when the shaft is free and when it is clamped.

Repeat procedure with each crankthrow. Bridge-gage readings show low bearings, but have little value in finding high bearings, except as a supplement to strain-gage readings, which show web deflection and thus shaft misalignment.

With an approved shafting level, check slope of each main journal and of adjacent main frame. Levels thus obtained indicate shaft contour and serve as an additional check on the strain-gage readings. If there are signs of misalignment, make a sketch of the shaft showing levels and maximum deflections. From this a skilled mechanic can scrape high bearings down to proper alignment. Flat spots, taper and out-of-round must always be kept in mind when interpreting crankshaft measurements. Good practice suggests that crank-web deflections should be held below 0.002 in.

If previous inspection of bearings has revealed an uneven or poor bearing surface, blue the shaft and replace the bearing cap with just enough shims to keep it from gripping the shaft and preventing turning. Pull down bolts evenly and with proper tension; then rotate shaft. This will indicate high spots on the bearings, which can be scraped.

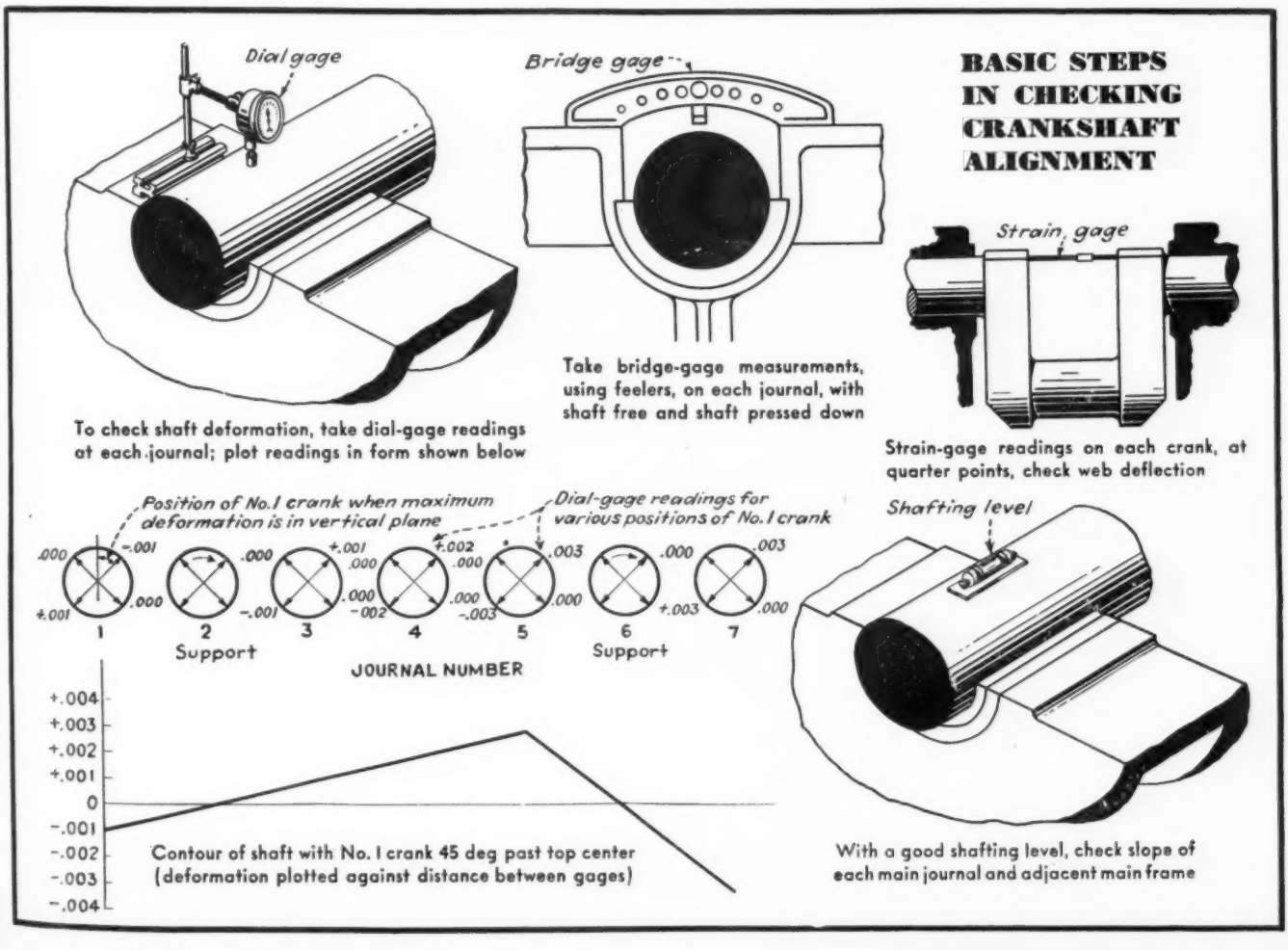
For a properly fitted bearing, adjustment is simple. Add proper amount of clearance to shims used for last bluing. Replace caps and tighten bolts.

If bearing inspection revealed no defects and only adjustment is required, use method of "taking leads" previously described for crankpin bearings.

A more detailed discussion of bearing and crankshaft alignment appeared in POWER, March, 1942, pages 94-96.

General Pointers: Before any overhaul, observe engine in operation, watching water and lube-oil pressures, valve mechanism, and governor operation. Indicate the engine and study cards for compression and combustion pressures, and any signs of irregularities. Listen for abnormal noises and note any condition that is unsatisfactory.

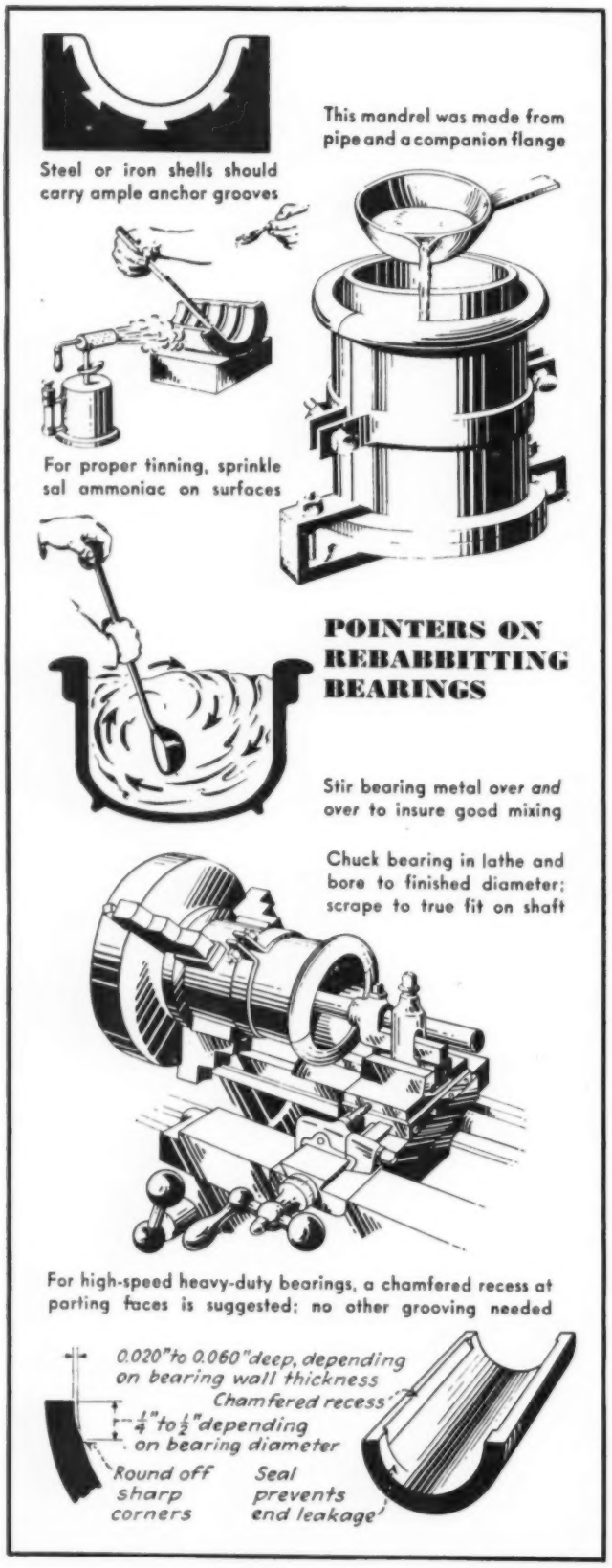
Dismantle the engine for overhaul in an orderly fashion, and mark all mating parts not previously marked by the engine builder. Set large parts on boards to protect the floor; put small parts in suitable receptacles to avoid loss. Clean all parts thoroughly with approved solvent.


BASIC STEPS IN CHECKING CRANKSHAFT ALIGNMENT
Dial gage
To check shaft deformation, take dial-gage readings at each journal; plot readings in form shown below
Bridge gage
Take bridge-gage measurements, using feelers, on each journal, with shaft free and shaft pressed down
Strain gage
Strain-gage readings on each crank, at quarter points, check web deflection
Position of No. 1 crank when maximum deformation is in vertical plane
Dial-gage readings for various positions of No. 1 crank
Support
Support
JOURNAL NUMBER
Contour of shaft with No. 1 crank 45 deg past top center (deformation plotted against distance between gages)
Shafting level
With a good shafting level, check slope of each main journal and adjacent main frame

REPAIRS

CAREFUL OPERATION, thorough inspection and regular maintenance virtually eliminate engine failures, but occasionally cylinder heads crack, bearings burn out, and crankshafts fracture. And, inevitably, liners, valves, pump plungers and shaft journals wear to an extent that makes satisfactory operation impossible.

In normal times, if the part can be repaired, decision whether to repair or replace rests on over-all cost. Today, with spare parts difficult to obtain and with every incentive to salvage as much strategic material as possible, the verdict becomes repair. The following pages outline some repair methods that have proved successful.


Steel or iron shells should carry ample anchor grooves
This mandrel was made from pipe and a companion flange
For proper tinning, sprinkle sal ammoniac on surfaces
POINTERS ON REBABBITTING BEARINGS
Stir bearing metal over and over to insure good mixing
Chuck bearing in lathe and bore to finished diameter; scrape to true fit on shaft
For high-speed heavy-duty bearings, a chamfered recess at parting faces is suggested; no other grooving needed
0.020" to 0.060" deep, depending on bearing wall thickness
Chamfered recess
1/4" to 1/2" depending on bearing diameter
Round off sharp corners
Seal prevents end leakage

Rebabbitting Bearings

Many engines now in service are equipped with split-sleeve babbitt-lined bearings; these can be relined successfully. Ease of replacement forms a feature of the *precision* bearing and the operator should not attempt relining.

The war makes formerly popular tin-base babbitts scarce. This means relining with salvaged metal or with a lead-base babbitt of desired properties (see POWER, May, 1942). Use of remelted babbitt can be entirely successful.

Don't mix with remelts of unknown or inferior quality. Guard against contamination; as little as 3% lead in a tin-base babbitt seriously reduces physical properties. This is equally true of lead-base babbitts; small amounts of tin represent contamination.

Relining starts with removal of old metal. Heat bearing to about 20 F above melting point of solder, using a blow-torch or a clean coke fire. Make sure all cored parts of bearing are free from moisture before heating. Remove all traces of oil, dirt, rust, or old lining by sandblasting, burning or pickling. Steel and iron shells should have anchor holes or grooves; on bronze shells, thorough tinning provides an adequate bond in most cases.

For tinning, "kill" muriatic acid by adding zinc scraps until reaction stops. Brush shell surface heavily with acid. Carefully preheat shell, then rub surface with solder stick. To insure thorough tinning, sprinkle sal ammoniac over the surface as the solder is rubbed into the grooves.

Use a mandrel slightly smaller than the journal to leave excess metal for boring. If not supplied by the engine builder, a serviceable mandrel can be made from a pipe and a companion flange. Place a piece of asbestos on the flange and clamp the bearing halves together with suitable parting pieces to separate the lining halves. Coat mandrel with oil, chalk, or a thin water-clay mixture. Wet fire clay around bottom edge of shell will prevent leakage.

Be sure mold is clean and dry, then preheat shell and mandrel to 250 F. Melt bearing metal close to mold to avoid cooling in ladle between pot and mold. Control temperature carefully, using a pyrometer if available. For a rough test, insert a pine stick into the metal; if temperature is right, stick should char but not burn. Keep molten metal thoroughly mixed before pouring; stir over and over.

Ladle should be large enough to fill mold in one pour. If no bottom-pour ladle is available, skim dross from surface or arrange for self-skimming as shown in sketch. Pour slowly to allow air to escape from mold. As metal shrinks on cooling, add more metal promptly.

After removing excess babbitt and clearing all oil holes, bore bearing to finished size. The sketch shows bearing chucked in a lathe; if too heavy to be chucked, clamp bearing to lathe carriage and mount boring bar between head- and tailstock, dogged to faceplate. Boring can also be done in a drill press; use a tool with two cutting edges to keep spindle from slipping sideways.

Before fitting the lining to the journal, check the fit of the bearing shell in the pedestal, to be sure that the heating has not distorted the shell. Then scrape the bearing to final

fit on the shaft journal, using Prussian blue, lampblack or, in a pinch, red lead thinned down with gasoline to check the high spots.

For high-speed heavy-duty bearings, a chamfered recess at the parting faces, as shown in the sketch, is recommended. If grooving is added, best location seems to be in low-pressure areas near the entering side of the high-pressure area. Make grooves shallow with well-rounded edges.

Mending Cracks

Piston and cylinder-head cracks, if not too extensive, may be repaired successfully by the methods outlined here.

To repair radial cracks in a piston crown, bore out weakened head metal and thread the opening. Cast a plug having slightly greater thickness than the piston crown and a stub at the top for wrench hold. Turn and thread plug to fit bored-out section of piston crown, as shown in sketch. Coat threads and the shoulder where the plug collar seats with iron cement. Force plug to a tight fit and, after iron cement hardens, cut off stub and finish head smooth.

Sketch shows a somewhat similar repair using a steel insert held in place by bolts and a retaining ring.

"Sewing" offers another method of crack repair. Start by drilling a hole at each end of crack to prevent further development. Then drill and tap a series of $\frac{3}{8}$-in. blind holes along the crack line (see sketch). Into these thread brass or steel plugs and cut them smooth with surface. Between these plugs insert a second row, overlapping the first plugs. Hammer the entire line of plugs smooth.

Also sketched is an improvement on the above sewing method. This depends on use of special low-coefficient-of-expansion steel strips, shaped as shown. At right angles to the crack, cut blind holes and slots into which the strips fit. After the first strip is inserted and peened, the same process is followed with succeeding strips until the holes and slots are filled. When the cracked casting becomes heated in operation, as would a cylinder head or jacket casting, the "chain-locked" strips expand less than the surrounding metal and tend to pull the crack together.

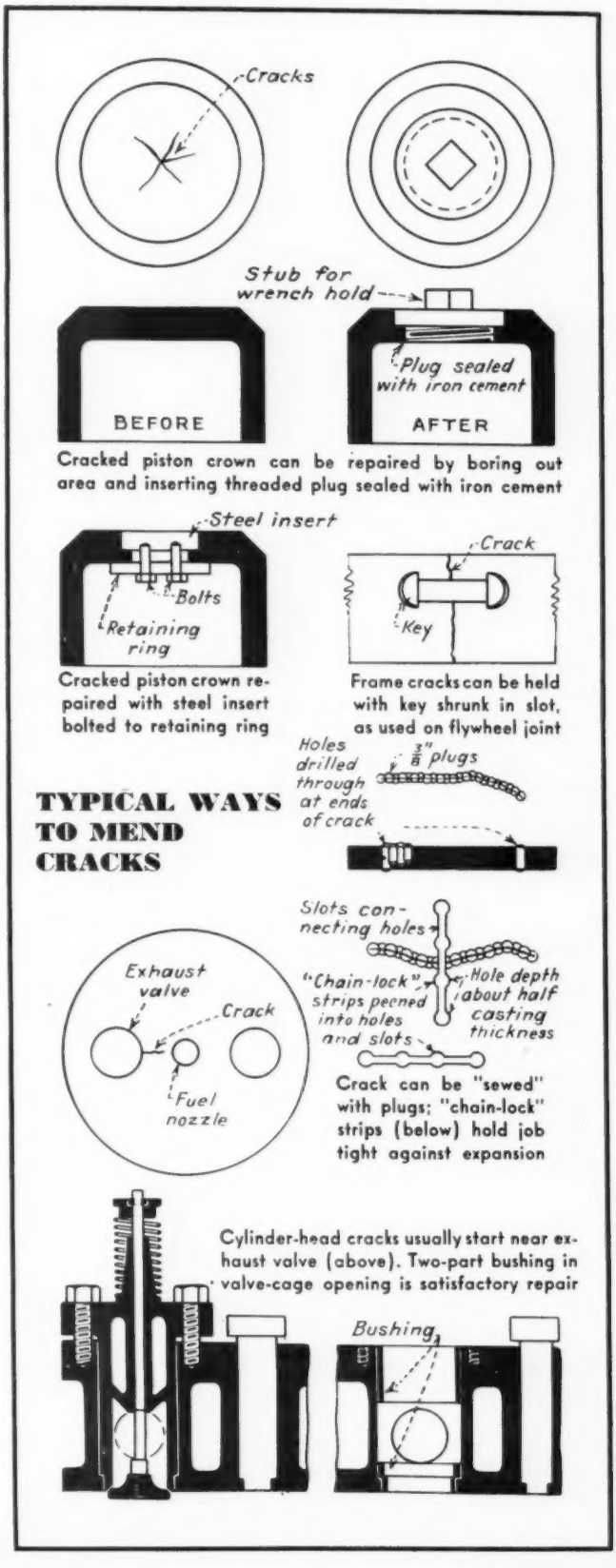
Cylinder-head cracks usually occur between the exhaust-valve and fuel-valve openings. If the condition is not too severe, the valve-cage opening can be bored out and bushed to seal off the cracks. As shown in the sketch, these bushings are usually made in two pieces, one at the top and the other at the bottom of the valve-cage opening, to clear the port opening. The lower bushing should be rolled-in like a boiler tube; if it comes loose it can be re-rolled.

Results with welded cylinder-head cracks depend on the method used and to a large extent on the welder's skill. Gas welding has been most widely used. Experience shows that merely chipping out the crack and welding it isn't enough. Usually it proves difficult to machine the shelf where the valve cage seats accurately enough to grind to a seat or hold a gasket. A better procedure involves machining out the valve port on the under side of the head and welding a bushing in place. This gives new metal to machine off for a seating surface.

Top importance attaches to preheating. Using a furnace which can be built of firebrick with a floor of firebrick supported by old grate bars or iron rods, bring the head to a dull cherry red slowly. This may take from 8 to 24 hr depending on whether the furnace is heated by gas or with a clean coke fire. Provide some means of moving the head and do all welding without taking the head out of the furnace.

Welding should be done slowly; it may take a full day's work to weld a head after it has been brought up to temperature. When welding is complete, close the furnace and allow from five to seven days for the head to cool enough to be taken out and prepared for the necessary machine work. Use a high-grade cast-iron welding rod.

Time is also the secret of successful electric welding of cylinder-head cracks. Cut out the area around the crack to form a 90-deg vee. If the metal is heavy enough, set small steel studs in the casting from $\frac{3}{4}$ to 1 in. apart. Apply two


TYPICAL WAYS TO MEND CRACKS
Cracks
Stub for wrench hold
BEFORE
Plug sealed with iron cement
AFTER
Cracked piston crown can be repaired by boring out area and inserting threaded plug sealed with iron cement
Steel insert
Bolts
Retaining ring
Cracked piston crown repaired with steel insert bolted to retaining ring
Crack
Key
Frame cracks can be held with key shrunk in slot, as used on flywheel joint
Holes drilled through at ends of crack
⅜" plugs
Slots connecting holes
"Chain-lock" strips peened into holes and slots
Hole depth about half casting thickness
Exhaust valve
Crack
Fuel nozzle
Crack can be "sewed" with plugs; "chain-lock" strips (below) hold job tight against expansion
Cylinder-head cracks usually start near exhaust valve (above). Two-part bushing in valve-cage opening is satisfactory repair
Bushing

gas or acetylene torches at the outside of the head parallel to the crack, expanding the head enough so that the weld, when completed, is under compression even when the head reaches maximum operating temperature. No other preheat is required; maintain the point where the weld is to be made at as near normal temperature as possible. Use soft steel rod of $\frac{1}{8}$ or $\frac{5}{32}$ in. diameter.

Lay down a short bead, two or three inches long, in the bottom of the vee. Peen it by hand or with an electric caulking tool if one is available. Lay down each bead in this manner, peening each one to expand the metal as much as possible during the cooling process.

Reclaiming Worn Parts

Under normal conditions, worn cylinder liners would probably be renewed and unlined cylinders would be rebored and fitted with oversize pistons. Reclaiming methods offer possible savings in both materials and cost.

The so called "dry liner" offers one reasonably simple solution. Bore out the liner or the cylinder wall enough to admit a thin liner on which the piston will travel. Follow the reboring with grinding. Make the liner slightly larger than the bored-out diameter and grind the outer surface. Chilling the liner with dry ice contracts it enough to permit slipping it into place.

Worn liners can also be reclaimed by metal spraying. One method starts with rough boring, taking off enough to true the liner; if wear is concentrated at top only worn section need be bored. A dovetail at end of rough bore prevents a feather edge at the joint.

Success depends on an absolutely clean surface to which the sprayed metal can bond. Sandblasting is usually considered essential and may be preceded by a hot cleaning bath. Spraying should follow cleaning immediately.

The usual setup calls for chucking the liner in a lathe, supporting it on a steady rest if the liner is long. The spray gun mounts on a boring bar fastened in the toolpost.

Another method involves boring out the cylinder or liner and building up the piston by metal spray. This permits simpler, external spraying and machining operations.

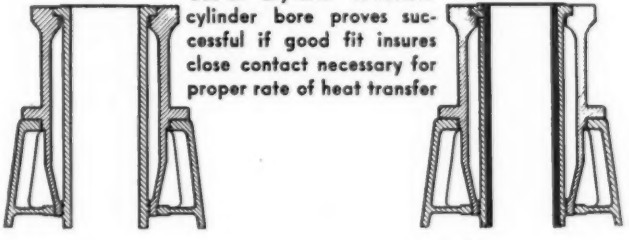
Metal spray may be used to build up worn crankshaft journals. The sketch below shows the lathe setup used by one shop. This involves a steel plate, faced off for good bearing, mounted on the lathe faceplate. The flange at the flywheel end of the crankshaft fits into a recess in the plate. The other crankshaft end receives a centering flange, carrying a bar welded to the flange-plate center. Both bar and plate are bored to fit the crankshaft, to which they are keyed. Two steady rests, set to journal size, grip any two companion journals while the plate bolted to the faceplate is shifted so that the end flange fits into the plate recess. After drilling a center hole in the centering flange at the opposite end, a rotating tailstock center is run into the hole. After removing steady rests, an indicator check shows any adjustment needed to align journals. Setup for main bearings is much simpler than that for crankpins.

Work begins with machining the journal and dovetailing the ends of the undercut. A blunt tool grooves the undercut portion and a special knurling device provides the many keys needed for a good bond. Carbon dowels plug oil holes during spraying operations.

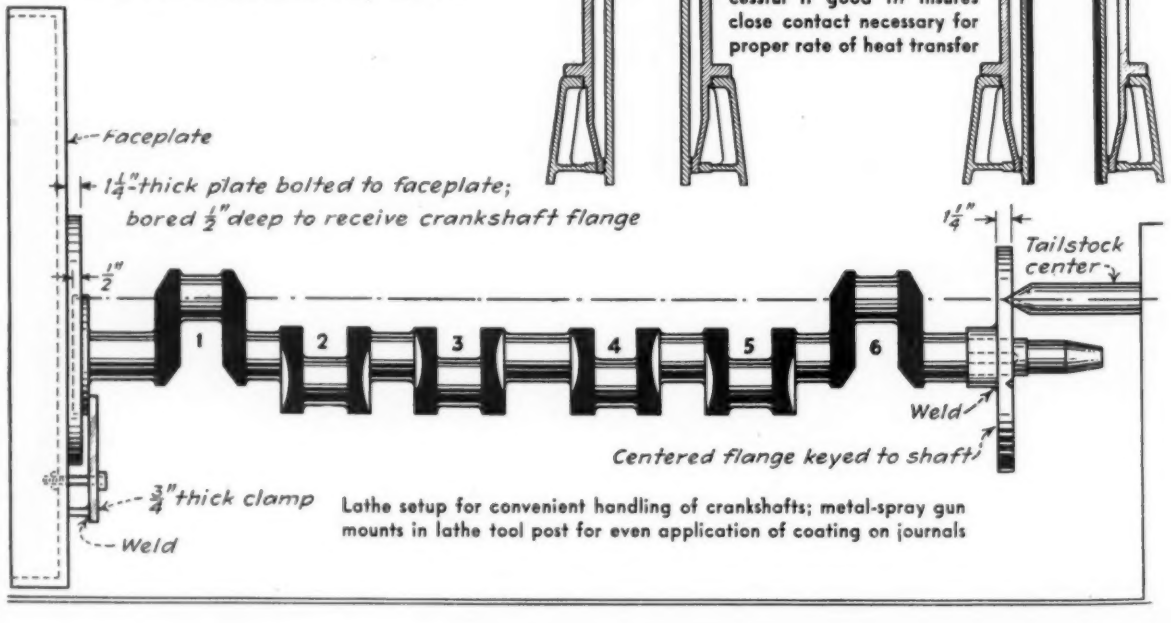
A spray gun mounted on the lathe toolpost applies the coating. Lathe turning with a carbide tool is followed by finish grinding, either with a portable lathe-mounted crankshaft grinder or in a regular crankshaft grinder.

Metal spray can be used to build up other engine parts, and hard-facing (see POWER, Dec, 1942) also proves a useful reclaiming tool, especially in connection with valves and other parts subject to wearing action at high temperature. Do not overlook the possibility, where several sizes of engines are installed, of turning down such items as valve stems, fuel needles and pump plungers for spares on smaller engines.

TWO WAYS TO RECLAIM WORN ENGINE PARTS



Use of "dry liner" to restore cylinder bore proves successful if good fit insures close contact necessary for proper rate of heat transfer



Lathe setup for convenient handling of crankshafts; metal-spray gun mounts in lathe tool post for even application of coating on journals

Practical suggestions for creating emergency capacity . . . substitutes for hard-to-get parts and materials . . . cures for overloads, breakdowns . . . ways to build up short-handed staffs. Share your ideas! Send in your rough notes and photos or sketches. Payment at regular rates

WARTIME POWER CLINIC

NEW KINKS FOR BOILER ROOMS

The editor asked Mr Reintjes, as a practical engineer experienced in boiler-room brickwork and refractories, to explain some of his newer designs and kinks, with special emphasis on wartime problems—in particular, shortages of metals and manpower.

HERE ARE TWO INCIDENTS from personal experience that show how we are meeting tough brickwork problems.

Boiler manufacturers have been delayed in meeting shipping dates, in some cases as much as four months. As a result, the mason contractor often has as little as ten days to brick the boiler in. Recently, a customer set the twenty-first of the month as the final date to start firing the boiler. Not until the nineteenth was the unit actually set, ready for the walls to be erected. We jokingly asked the customer to light drying-out fires before we started the brickwork.

We had a similar problem with a manufacturer who was delayed three months in erecting a boiler needed to furnish heat for thousands of troops. We inclosed the boiler in less than ten days, starting drying-out fires before the last mason had scrambled out of an upper door in the setting. Three days later the boiler was running at peak capacity.

Air-cooled Furnace Floor

Walls, fans and burners of air-cooled furnaces are often connected by unsightly, space-consuming metal ducts. Since metal is also difficult or impossible to obtain now, we designed an air-cooled floor, Fig. 1. Air circulates down through the double walls to ducts beneath the floor. They carry the air to the fans, which force it through the center lane beneath the floor to the burner housing.

Metal is not required in floor nor for ducts. Heat pickup is greater through furnace floor than through walls, so the air gains a large proportion of its final temperature after it leaves the fan. This prevents overheating fan bearings and saves fan capacity.

The floor is built of an all-refractory arch, which, although flat, is interlocked and hinges, moving upward when elongated by expansion. It can therefore be used between supports on 6- to 8-ft spans.

Fig. 1 shows openings that admit air to hollow walls. Note free-swing inlet air-damper doors, with adjustable counterweights to equalize air flow from the various lanes. This insures maximum heat recovery and, more important, tends to equalize temperature in various parts of the wall.

Burner Squaring Tile

Most oil and gas burners are circular and require toilsome fitting of the refractories to the frame circle.

Generally, a mason used to cut and set the flat-course bricks to fit the burner ring in six to twelve hours. To

(CONTINUED ON PAGE 98)

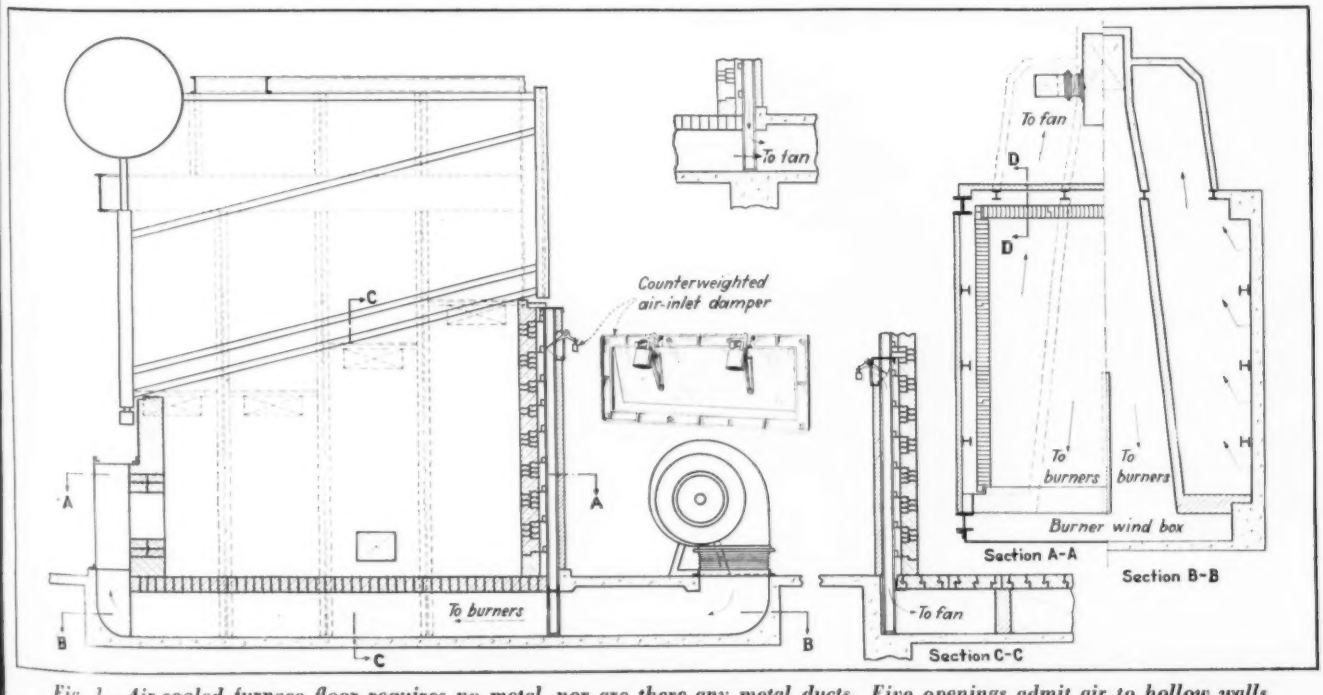


Fig. 1—Air-cooled furnace floor requires no metal, nor are there any metal ducts. Five openings admit air to hollow walls

Many Companies select Riley Pulverizers

Parkchester to Convert 171 Buildings for Coal

The Parkchester development in the Bronx, which normally consumed 8,000,000 gallons of fuel oil a year to supply heat and hot water for its 171 buildings, will convert to coal, it was announced yesterday.

The conversion, which is to start at once and is expected to be completed this Summer, will cost the Metropolitan Life Insurance Company, owners of the development, more than $500,000. The Parkchester power plant will consume 35,000 tons of coal a year.

Announcement of the conversion plan was made following a conference among Bronx County Rationing Administrator Adolph J. Chesley, Frank C. Lowe, resident manager of the development, and representatives of the regional Office of Price Administration and other governmental agencies. Mr. Chesley said the oil normally required for the development's 12,272 apartments was one-tenth of the entire consumption in the Bronx.

The development's normal fuel oil consumption was reduced by nearly 50 per cent last Winter under what Mr. Chesley described as a "severe" ration.

New York Times
April 1943

when converting from oil to coal firing

When converting boilers, particularly of the larger sizes, from oil firing to coal firing, Riley Pulverizers are a natural selection when furnace volumes are or can be made adequate for the steam capacities desired. Because of their compact design, comparatively small space is required for their installation.

As extensive foundations are not required and as many oil fired furnaces have proper characteristics for pulverized coal firing, Riley Pulverizers can normally be installed with a minimum of construction.

The following design and operating characteristics have resulted in the selection of Riley Pulverizers in hundreds of the country's leading industrial and central station plants.

1. Low cost of installation
2. Small space required to install
3. Ability to carry low loads
4. Flexibility — wide load range
5. Sustained fineness of pulverization
6. Low maintenance
7. Ease of part replacement
8. Ease of lubrication
9. Accessibility of parts and bearings
10. Low power consumption
11. Quiet vibrationless operation
12. Reliability — High operating availability
13. Ease of control and operation
14. No explosion hazard in pulverizer

RILEY

STOKER CORPORATION, WORCESTER, MASS.

Boston New York Philadelphia Pittsburgh Baltimore Buffalo Cleveland Detroit Chicago St. Louis Cincinnati St. Paul Kansas City Denver Seattle Portland Los Angeles Houston New Orleans Atlanta Memphis Richmond

COMPLETE STEAM GENERATING UNITS

BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • FLUE GAS SCRUBBERS
ECONOMIZERS • WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • AIR HEATERS

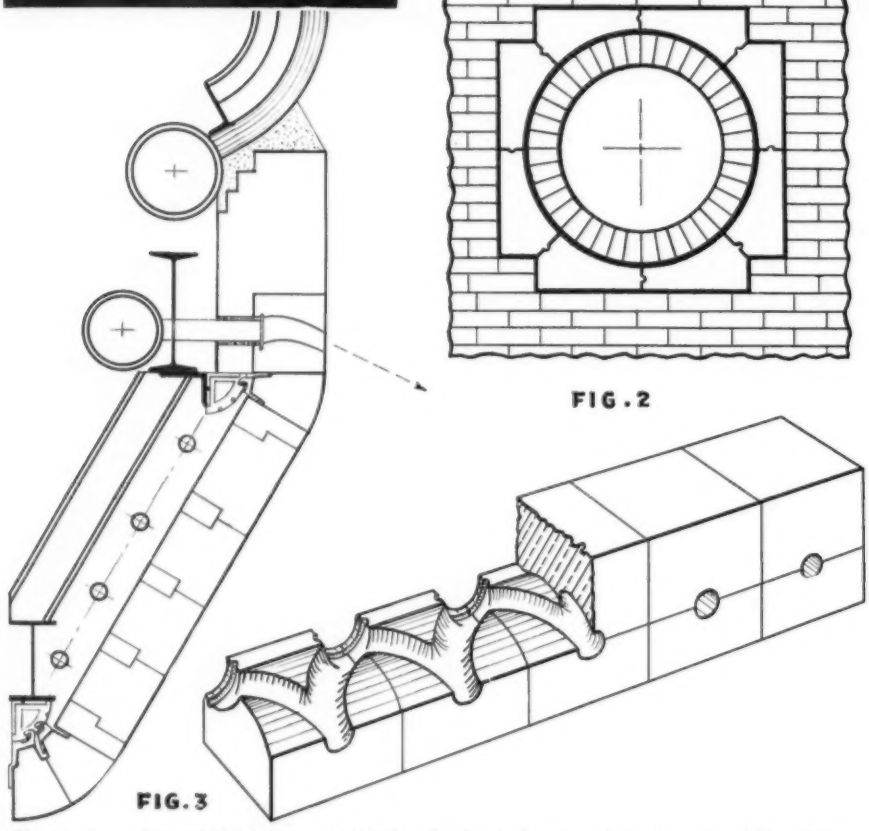


Fig. 2—Interchangeable left- and right-hand tile fit burner ring. Fig. 3—All-refractory nozzle receives air from outside plenum box through metal tubes

(CONTINUED FROM PAGE 95)

eliminate this labor, we designed tile to match the circle inside and to bond square with the brickwork outside. Now, a mason takes only 15 to 20 minutes to install each ring.

Each burner requires eight "squaring tiles," Fig. 2, which look like left- and right-hand tiles, but which are actually so designed that a tile is converted by merely turning it end to end, while still preserving correct arrangement of tongue-and-groove seals. Since both sides of a tile are tongued half the length and grooved the other half, a refractory ring of given diameter requires only one size and shape of squaring tile.

Overfire Air Nozzles

Overfire air helps combustion tremendously, especially when firing with chain-grate stokers. At first, burner nozzles were merely pieces of pipe inserted in the walls, but this pipe soon oxidized and the metal filled the holes. Gradually chrome- and nickel-alloy nozzles were adopted, but they clogged with slag and molten refractory, and thus lost efficiency.

The all-refractory nozzle, Fig. 3, eliminates the difficulty and also solves the wartime problem of strategic metals. It receives air from an outside plenum box through thin-gage metal tubes. Curved passages protect air inlets from furnace radiant heat.

Tile design is such that air flows not only from the block into the furnace but also lengthwise through the row of blocks. Moving air within the block cools the refractory's inner face so that slag flowing down the walls is chilled and blown off before it clogs the nozzles.

Kansas City, Mo. G P REINTJES

Any Post-War Ideas?

The war's still to be won, but engineers have to look ahead. Who's doing something now in his plant for post-war ends? Let's hear!—Editor

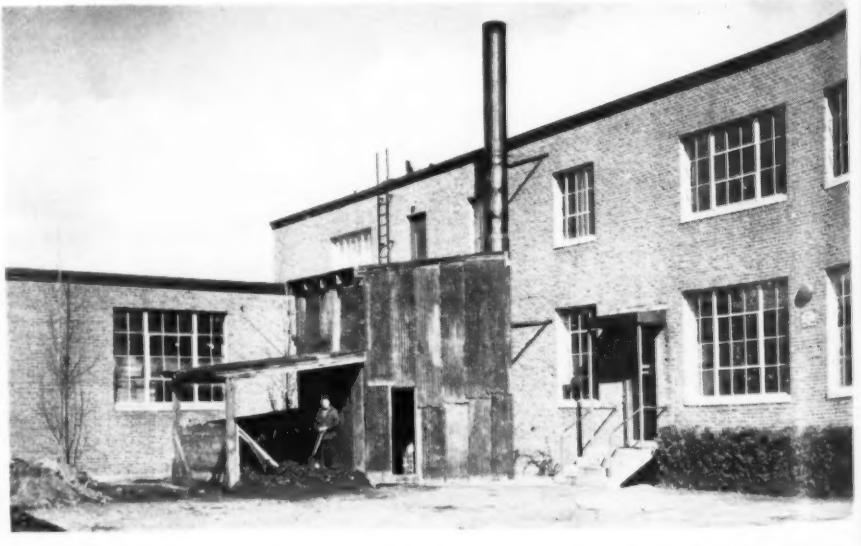
Yankee Ingenuity Licks Fuel Problem

WHEN OUR FACTORY was erected in 1940 no consideration was given to any fuel but oil. Briefly, in cooking Wright's Silver Cream we require a large volume of quickly available steam, but most of the time we are not much interested in steam pressure for heat.

Converting oil-burning equipment to coal would have been slow, tedious and expensive, and we had no coal-storage space. So last year we hunted around and found a secondhand boiler in an old granite quarry. From sawmill operators we bought sections of metal stack, which we welded together. Next, we located a secondhand pressure-reducing valve and return pump. We set up all this equipment back of our building. As the photo shows, the makeshift housing is secondhand timber and old corrugated iron sheet.

This improvised unit did the job in extreme weather, and when oil is again available we can switch over in about five minutes. Total expense was about one-third of the cost of converting to coal and then, later on, back to oil—not to mention time, trouble and work stoppage involved in conversion.

Keene, N. H. JOHN P WRIGHT



Secondhand timber and old corrugated iron sheet house a secondhand boiler, pressure-reducing valve and return pump. Metal smokestack sections are welded together

Electrical Equipment—Weapons and Tools

From miniature motors to mammoth generators, from tiny detector tubes to great broadcasting stations—everything electrical is essential to our war effort

AS this editorial goes to press, newspapers and radio news commentators are telling the dramatic story of the blasting of two mighty Nazi power dams. Floods are sweeping down the Ruhr Valley, Germany's most vital munition production center. Two vast networks of industrial activity lie inert, for the great generators that had fed power to hundreds of plants producing war goods for Hitler, today stand idle. This daring raid will go down in history as one of the most, if not *the* most devastating of the entire war. It has destroyed two great sources of power, stopping the wheels in hundreds of plants and throwing into darkness thousands of factories and homes.

This epoch-making raid by the R.A.F. brings home to us the vital importance of our own power resources, those colossal generators from which flows the current that turns the wheels of our great industries, illuminates our factories and homes and runs our electric railways and subways. It makes us realize how dependent we are on electricity and how important is the part of those manufacturers who produce the electrical equipment that makes possible its generation and use.

Beginning with Thomas A. Edison, the inventive genius of electrical manufacturing men has devised more and more efficient ways of generating the current, better and better means of transmitting it and of applying it to do thousands of jobs quicker and better.

The products of electrical manufacturers have become so completely an essential component part of every industrial, business and domestic activity that our economy and our war effort could not go on without it.

In days of peace the laboratories of our electrical industry gave us radio, fluorescent lighting, infra-red drying, precision process-control, telemetering, split-second circuit breakers and many other things that border on the miraculous.

Today their facilities and their genius are devoted to an all-out war of wits with Axis scientists and production men.

Electricity plays a significant part in this war . . . from the "walkie-talkie" that brings support to hard-pressed outposts, to the mammoth motors on the battleships. While many electrical developments today are cloaked in secrecy, the nation will enthusiastically applaud these electrical manufacturers when the curtain is lifted.

The far-reaching importance of electrical instruments, apparatus and machines becomes evident when we consider that over 350 different electrical items go into combat vessels and that more than 170 go into a fighter plane. Most of these products are distinctly special in nature and are far removed from their civilian counterparts if, indeed, they have such counterparts.

To the civilian, a light bulb is something so standardized that every need can be filled by any nearby dealer. Our armed forces, by contrast, must have at their disposal more than 400 distinct types of lamps. Some no larger than the head of a match, are so brilliant that they flash signals under a tropical noon sky. Others are built to withstand extremely low temperatures, vibration, shock and many other abuses to which they are subjected.

On planes, for example, numerous fractional-horsepower motors are used but the standard industrial motor is not suitable for this service. New records in low weight-per-horsepower had to be achieved involving extensive changes in design and production.

To prevent the light from instrument panels from impairing the vision of night fighters, ultra-violet radiation which activates fluorescent instrument dials was developed. As a result, the pilot may look out into the darkness after reading his instruments without the least effect on his eyes. How many precious air victories can be credited to this one development alone?

But, in general, the story of this industry's war work is much too blurred by military censorship to afford an adequate picture of its contributions. The factories and shipyards that are turning out war matériel tell a more complete story. Many of these have been built during the past two years. Others have gone through a complete conversion process. In every case, large quantities of electrical materials were involved.

In the broadest sense, there are three major jobs which this industry has had to do, in addition to equipping our modern war machine. It has had to supply materials for the vast expansion of our industrial system, keep every plant fully maintained, and provide the necessary equipment for the vital power and communication fields.

More than $1,900,000,000 was spent for new industrial construction in 1942, and of this about 7% or $140,000,000 was for electrical materials. New machine tools and other production equipment required an additional $350,000,000 worth of electrical products. The conversion program called for another $145,000,000 of electrical apparatus and supplies.

This total of over $600,000,000 in itself would have staggered the electrical industry in a peace-time year. Yet, this record-breaking production was essential and had to be superimposed upon the direct requirements of the Army and Navy.

Industry depends upon electricity. Consider for a moment the effect of modern lighting upon war production. Industry enjoys levels of illumination and color quality that were undreamed of ten years ago. As a result, midnight shifts operate at daytime efficiency. As a matter of fact, many of the more modern plants have no windows at all.

Then there is maintenance. The failure of one single motor or feeder will stop a production line. Electrical manufacturers have had to stand at all times ready to

supply the heavy demand for the maintenance and repair parts that keep our industrial machine operating at top speed. Excess loads, 24-hour schedules and inexperienced production hands combine to shorten the lives of electrical equipment.

Electrical manufacturers have had to supply the greatly expanded needs of our power and communication systems.

New construction of all sorts — war plants, cantonments, war housing — has created a formidable need for additional capacity. Every element in our domestic economy has called for increased communication and power services. All this had to be superimposed upon the vast demands of our armed forces. The magnitude of this task is obvious but it is being successfully accomplished. Every old installation is functioning smoothly and every new one has been ready to function on exact schedule. There has been no failure either in our power or in our communication. Part of the credit for this performance belongs to the hundreds of manufacturers who delivered their products when and where they were needed.

This was not merely a problem of increasing production. These manufacturers had been depending on rubber, copper, aluminum and steel — all highly critical materials. For much of their non-military production they suddenly had either to find substitutes or practice the utmost economy and ingenuity.

Solutions to many problems were quickly found. Lighting manufacturers greatly reduced their use of steel by designing efficient, non-metallic reflectors. Wire and cable manufacturers expanded their use of synthetic insulation in place of rubber and they promoted the use of higher distribution voltages so that every ounce of copper would work more efficiently.

Steel is essential in apparatus that operates magnetically. There is no known substitute. But marked economies in its use have been achieved through the development of new alloys that are of increased magnetic efficiency. As a result, motors and transformers now consume substantially less steel than did units of equal capacity a year or two ago.

Electrical manufacturers have given our industries numerous new production tools. Infra-red heating tunnels, for example, have drastically reduced the time involved in production drying . . . in some cases from hours to minutes. High-frequency induction-heating has been spectacularly successful in the forging, brazing, hardening and casting of ordnance. Modern welding equipment makes possible speedy production with inexperienced labor.

America's production lines are being patrolled by electrical devices which eliminate human error. One million volt X-ray equipment looks through castings and points an unfailing finger at defects. An electronic flaw detector tests nonferrous drawn-metal tubing for imperfections. Other electronic devices are counting and sorting the products of thousands of war plants. Precision controls regulate all sorts of processes, from aluminum production to armor plate annealing.

These are but a few of many examples of the way in which the magic power of electricity has been harnessed to the war effort. Back of every development there is at least one electrical manufacturer — more often many — who have pooled ideas and methods with no thought of royalties or dispute over cost allocation.

No story of the electrical industry would be complete that did not pay tribute to those manufacturers who have dropped their normal lines in order to produce special war products. Many appliance manufacturers fall in this group. When war came, they did not stop to argue that civilian morale and big pay checks would demand a continued supply of their products, instead they quickly shifted to the production of war matériel and today they are deep in the manufacture of machine gun parts, aircraft sub-assemblies, and even gas-mask fabric. They have had to abandon their hard-won markets for the duration; but they are contributing mightily to permanent peace and a more prosperous world to which they will return when the guns are silenced.

This great industry has increased its production threefold in two years — $2,500,000,000 in 1940 to $7,500,000,000 in 1942. It has done this with all the zest of youth, for this is a young and a pioneering industry. Few companies in this industry are fifty years old; the majority are much younger. Top management in general is young, too, and many outstanding technical developments have come from the brains of men just a few years out of college.

The results of all its intensive intelligent work can be found in every factory, on every battlefield and ocean, and even in the flak-spotted air over Berlin. In a sense, the electrical manufacturing industry stands beside every soldier and every sailor as he goes into action. It has a place of honor it richly deserves.

And when this war passes into history, as it surely will, our soldiers and sailors returning to peace-time jobs, will find a life greatly enriched by electrical developments that were undreamed of yesterday.

James H. McGraw, Jr.

President, McGraw-Hill Publishing Company, Inc.

This is the twelfth of a series of editorials appearing monthly in all McGraw-Hill publications, reaching more than one and one-half million readers, and in daily newspapers in New York, Chicago and Washington, D. C. They are dedicated to the purpose of telling the part that each industry is playing in the war effort and of informing the public on the magnificent war-production accomplishments of America's industries.

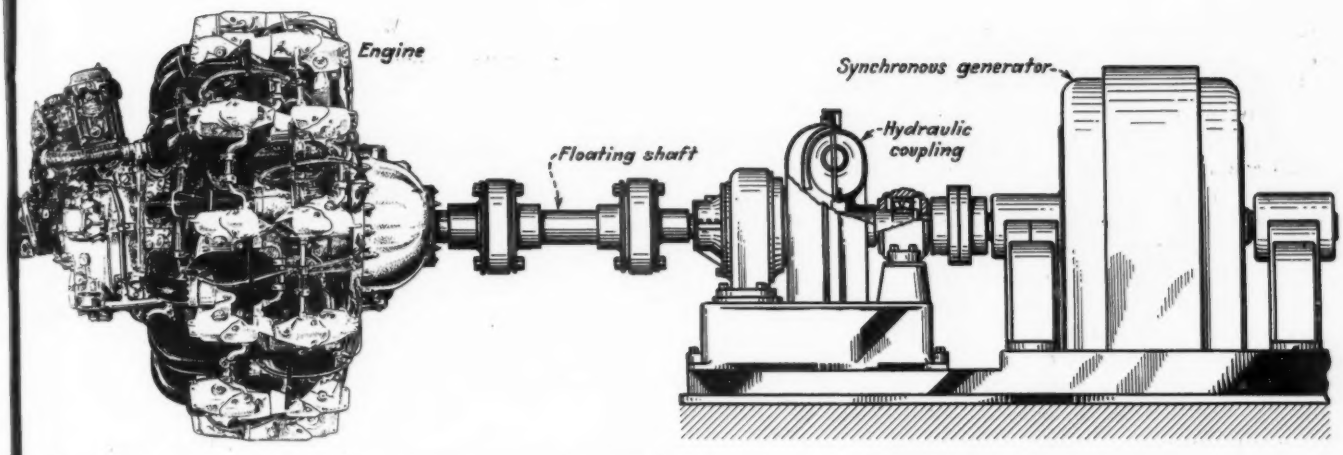


Fig. 1—This system, developed to recover power for manufacturing, uses a variable-speed fluid coupling to connect aircraft engine under test to a synchronous generator that must operate at constant speed to work in parallel with plant power system

Aircraft-Engine Tests Provide New Source of Manufacturing Power

Instead of wasting their power driving propellers in trial tests and run-ins, aircraft engines now drive electric generators that supply up to 60% of the total power for manufacturing operations. The system is economical, makes engine loading easy and conforms to testing needs

▶EVERYONE WHO HAS DRIVEN a new car knows that he is supposed to drive at reduced speed for the first 500 to 1000 miles to break-in the engine. This cannot be done with an aircraft engine, because maximum engine power is required at takeoff to get the plane into the air. Consequently, before a new aircraft engine goes into service it must be thoroughly run-in to develop full power and speed without injury to any of its parts.

Running-in an engine is complicated. First step is to operate it under sufficient variety of loads and speeds to insure good operating condition. Then, if a check shows satisfactory performance the engine is returned to the manufacturing department where it is completely dismantled and inspected. Next, it is assembled and returned to the test department for a shakedown run of several hours. Finally, it is given an acceptance test.

Until 1937, all aircraft engines were loaded during breaking-in and test periods by propellers, water brakes, electric brakes and similar devices. With all these, engine power was wasted. As engines increased in size not only did the amount of wasted power increase, but dissipating the power in any of the then used devices became a serious problem. Moreover, wasted power represented a large part of that required to operate the plant where the engines were manufactured. Naturally, methods of recovering at least part of this power attracted the attention of aircraft-plant engineers.

Recovery of power from aircraft engines presents several problems. One of these is: An aircraft engine during breaking-in operates at different speeds, while the generator, for converting engine power into a form that can be

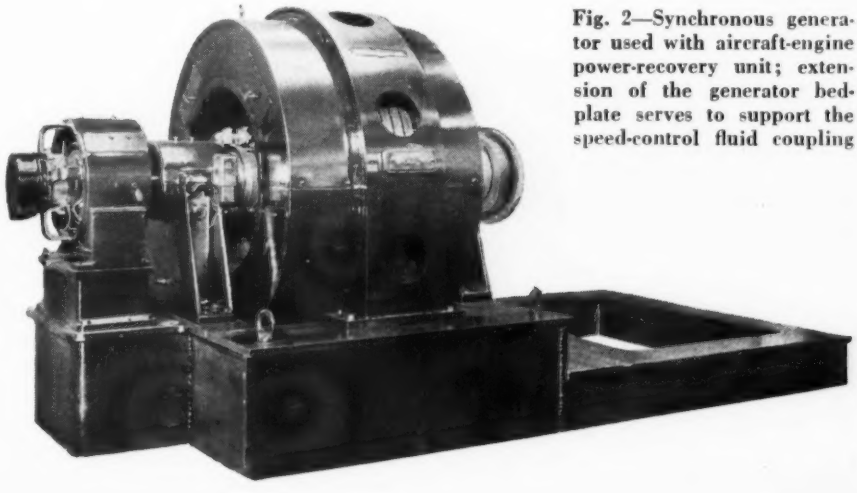


Fig. 2—Synchronous generator used with aircraft-engine power-recovery unit; extension of the generator bedplate serves to support the speed-control fluid coupling

taken into the plant distribution system, must operate at constant speed.

In 1937, the Pratt & Whitney Aircraft Division of United Aircraft Corp, East Hartford, Conn., in cooperation with General Electric Co and the American Blower Corp, attempted to develop a system of power recovery from aircraft engines. To be successful, the system had to be economical to install and operate, return a large part of engine power to the plant distribution system, make loading of aircraft engines simple and easy, while conforming to the needs of aircraft-engine testing. Out of these preliminaries, a system was developed that meets these requirements.

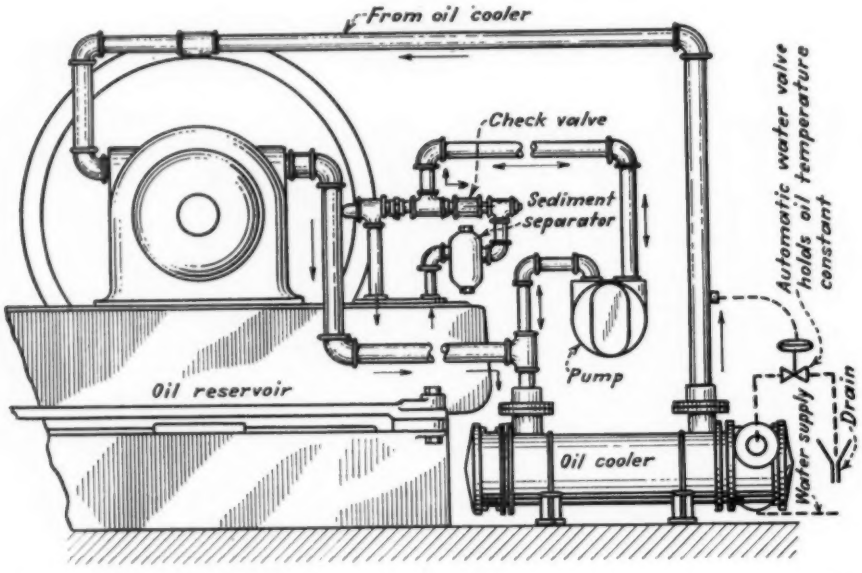


Fig. 3—Oil leaks off through nozzle from coupling, when it is in operation, and is cooled in a heat exchanger and then returned to the variable-speed coupling circuit

This power-recovery system uses a variable-speed fluid coupling to connect the aircraft engine under test to a synchronous generator, as in Fig. 1. The first two of these units were put into service by Pratt & Whitney Aircraft in 1940. A photo of a synchronous generator used with power recovery units of this type is shown in Fig. 2. Extension of the generator bedplate serves to support the fluid coupling.

The power-input part of a fluid coupling acts as a pump discharging liquid into the power-output part to drive it as a waterwheel. Flow of the liquid (oil) is the only connection between input and output parts of the coupling. Speed of the power output part in relation to the input part depends upon the amount of oil in the coupling. With the working circuit of the coupling full, output speed at rated load is about 3% less than input speed. As the amount of oil in the coupling is reduced its output speed decreases. This action assumes constant-speed input and adjustable-speed output, such as is used when the coupling adjusts the speed of a fan or pump that is driven by a constant-speed motor.

On an aircraft-engine power-recovery unit the engine normally operates at some speed above that of the generator. For example, if the normal run-in speed range of the propeller shaft is between 750 and 1200 rpm, generator speed is 720 rpm. Then, for any given set of test conditions fluid is admitted to the coupling to load the engine to the desired amount for a coupling output speed of 720 rpm.

A squirrel-cage winding in the pole-faces of the generator rotor permits starting it as a synchronous motor on full voltage by direct connection to the power system. When starting an engine for a break-in and test run, the generator is brought to speed as a motor without fluid in the coupling, to permit the motor to start without load. The coupling is then partly filled with enough oil to turn the cold engine over without firing. After a suitable period, the engine is fired and run light until it warms up. During this period oil is removed from the coupling so that the motor does not help turn the engine.

Loading the Engine

Once warmed up, engine speed is increased above that of the motor. By adding oil to the coupling, the engine tends to drive the motor above synchronous speed and it thus becomes a generator to load the engine. Regulating the engine throttle and amount of oil in the coupling controls load on the engine at any given engine speed above synchronous speed of the generator.

With this operating method, the engine is loaded only when it tends to drive the generator above synchronous speed. Should it become necessary to load the engine at generator speed below synchronous, it would be possible to hold the generator rotor stationary and use the coupling as a hydraulic absorption dynamometer.

Maximum load that can be applied to the engine depends upon capacity of the coupling cooling system to dissipate the heat represented by the power absorbed by the coupling. Normally, at engine speeds below synchronous speed of the generator, power developed by the engine is no greater than the maximum the coupling has to absorb when engine operates at maximum speed. Consequently, a coupling large enough to handle the load during maximum power recovery from the engine has sufficient capacity to act as a hydraulic brake to load the engine below synchronous speed of the generator. At low speeds, also, duration of test runs is comparatively short so that energy loss absorbed by the coupling is a relatively small part of the total the engine delivers during a break-in run.

When the engine runs above or below synchronous speed of the generator, slip in the coupling heats the oil, as previously mentioned. This oil leaks off through a nozzle and is circulated through a heat exchanger where it is cooled and returned to the working circuit of the coupling. On the heat exchanger, a water-flow control valve in the water-outlet line holds oil temperature practically constant to eliminate changes in oil viscosity and expansion. Fig. 3.

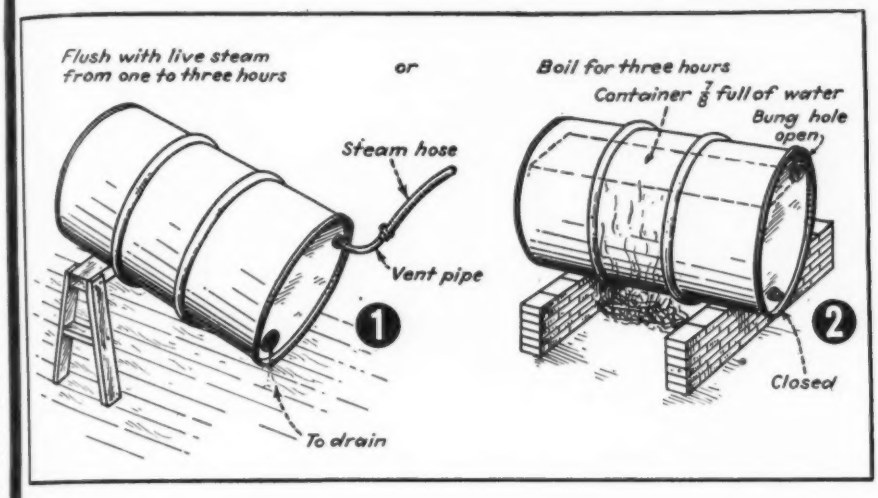
Engine Safety Devices

Aircraft engines operate without governors so that on a sudden loss of load they overspeed. To provide against overspeed, centrifugal switches on generator and engine shafts cut out engine ignition and fuel supply. Other safety devices prevent starting or running an engine when cooling water is turned off or lubricating oil fails.

It is possible with aircraft-engine power-recovery systems to return to the manufacturing-plant power system from 50 to 60% of the total power needed for plant operation. This is sufficient to amortize the extra cost of power-recovery equipment over non-recovery methods in one to three years, depending on cost of purchased power, size of engines tested and number of hours per year that the test stands operate. In addition to this saving, large engines can be readily loaded by power-recovery methods and our fuel supply conserved.

This Saboteur Can Make Welding Repairs Risky

Even small amounts of explosive vapors that linger in gasoline and oil containers can cause serious accidents. To get rid of this unseen danger, clean drums or tanks by one of these three methods recommended for emergency welding by the National Safety Council



Whether you flush a container with live steam, Fig. 1, or boil it ⅞ full of water over an open fire, Fig. 2, be sure that welding is done within half an hour

▶ WELDING A LEAKY CONTAINER by the roadside may be all in the day's work if you tackle the job with a knowledge of some simple safety rules. But you are playing a risky game if you do not first clear the inside of explosive gas. Principal danger is that gasoline and oil vapors may explode in a semi-inclosed space. such as a container. Accordingly, all vapor must be removed by circulation of steam to avoid the hazards listed below.

When cleaning solutions, live steam and combustible-gas indicators are used according to recognized standard Method 1, safety from explosion is assured. But since this equipment is not always available, Method 2 tells how to clean safely with hot water and live steam, Method 3 with hot water and steam over an open fire. The methods apply to containers with a capacity of 50 gallons or less.

Method 1—Remove vapors with cleaning solution and steam; test with combustible-gas indicator (recognized standard method):

(*a*) Place container where there are no open flames, unguarded electric lights or other sources of ignition.

(*b*) Remove bung with a suitable wrench, being careful not to cause a spark. Do not use hammer and chisel.

(*c*) Wash out container with a solution of caustic soda, soda ash (washing soda), trisodium phosphate, etc. Rotate container mechanically for five or ten minutes and drain thoroughly.

(*d*) Flush with live steam for one hour, tilting container so that contents drain out.

(*e*) Inspect the inside to see that it is clean. If it contains scales, agitate the interior with a chain and tap the exterior with a mallet, then repeat washing and flushing.

(*f*) Test vapor content with approved combustible-gas indicator.

(*g*) Make welding repairs within 30 minutes after steaming—that is, while container is still hot. Be sure bung is still out.

Method 2—Remove vapors with live steam only:

(*a*) Same as Method 1.

(*b*) Same as Method 1.

(*c*) Drain container and flush several times with hot water.

(*d*) For gasoline container, flush with live steam three hours; for oil container, one hour. Tilt container so that contents drain out during operation, Fig. 1.

(*e*) Do welding within 30 minutes following steaming operation—that is, while container is still hot. Be sure bung is still out.

Method 3—Remove vapors without cleaning solution and live steam, also without testing with combustible-gas indicator:

(*a*) Same as Method 1.

(*b*) Same as Method 1.

(*c*) Flush container several times with hot water and thoroughly drain contents.

(*d*) Place container. about ⅞ full of water, over a fire, as in Fig. 2.

(*e*) *Boil three hours.*

(*f*) Weld within 30 minutes after steaming. When this is not possible boiling must be repeated. See that bung is still out.

WATCH THESE HAZARDS

1. Petroleum vapors are 3½ times heavier than air and remain indefinitely in semi-inclosed spaces unless removed by circulation of air or steam. A mixture of air containing 1½ to 6% gasoline vapor explodes if ignited. Under certain conditions, a mixture that contains as low as 0.2% gasoline vapor may explode.

2. When caustic soda is used, guard against alkaline burns to person or clothing.

3. If a metal steam line is used, it should be electrically bonded to the container to drain off static accumulation.

4. When repairing a container with more than one compartment, clean the other compartments as thoroughly as the one needing repairs by the same method.

Before going to work on top of an elevator car be sure the operator can be depended on to follow your instructions and not start the car unexpectedly

Working Around Elevators? Don't Take Any Chances

Thomas Trail, Baltimore, Md., draws upon his wide experience in elevator work to give some of the causes of accidents to passengers and workmen. Caution and a little common sense go a long way in preventing accidents and even fatalities

▶ As INEXPERIENCED PERSONNEL maintain more and more elevators, the causes of elevator accidents call for close scrutiny. Serious hazards exist, particularly for those who maintain elevators, even though modern ones in good operation are the safest means of transportation.

These safe modern elevators are in such wide use that most people accept them with little thought that dangers may exist around them. Unlike most other equipment, they are dangerous even when they are not in motion. For instance, hoistways and hoistway doors are a continual hazard. Most accidents occur around these doors: bolts, screws, guides and other parts come loose or even drop off. Therefore, keep hoistway doors—and car doors, too—in good condition.

Here are some instances that indicate the seriousness of elevator accidents. Many of them can be avoided by applying caution and a little common sense.

Door guide fell into hoistway: Fortunately, the door did not follow the guide. However, if someone had been leaning against the outside of the door, he might have fallen into the hoistway with the door. Or it might have swung out far enough to be caught by the car, an automatic landing type. Then almost anything could have happened—even fatal injury to the passengers.

Bolts in top section of hoistway door were loose: The defect was discovered after a heavy truck, rolling off a freight elevator, knocked the door's top section out of place. If the door had not been hit, it might in time have worked loose and fallen into the hoistway.

Door locks are not always properly maintained: As a result, many people have opened doors and fallen into empty hoistways. One woman reached the doors just as an operator closed them. Apparently the locks were defective for she managed to pull the doors open and stepped through, only to fall 17 stories.

Use of Emergency Key

Using an emergency key to re-enter a car should serve as a warning: And yet, strange as it seems, many operators and mechanics fall into hoistways by accident. For instance, an operator leaves a car and closes the door, and in his absence someone takes the car away from the floor. If the operator unlocks the door with his emergency key and takes it for granted that the car is where he left it, he may step into an empty hoistway.

Believe it or not, this form of carelessness has had such serious results that in many buildings hoistway doors are double locked. When the car is at the floor an emergency key opens the doors from the outside. But if the car is no longer at the floor, a second key or device is needed. Always assume when you open doors from the outside that the car is not at the floor.

Carrying long lumber may cause accidents: I know of two accidents that occurred when long lumber was carried on top of a car or with ends extending through a hole in its roof. In one case, the operator ran the lumber, which extended through the car's roof, into the top of the hoistway with such force that the hoist ropes were pulled from their sockets. For some reason the safeties failed to hold and the car fell, killing one workman and injuring another.

Installation Accidents

All parts of controller must be in good working order when a car moves: A mechanic partially removed a disk cam

(*Continued on page* 154)

THE OPERATING ENGINEER

George Edwards *Advisory Editor*

PRACTICAL AIDS · MAINTENANCE HINTS · QUESTIONS — ANSWERS

PUBLISHED MONTHLY AS AN INTEGRAL PART OF POWER

Doing All You Can with the Feedwater System?

Three years ago, L D Johnson, chief engineer, State Prison of Southern Michigan, faced with a bottleneck on steaming rates, went as far as a modest appropriation would permit in licking his problems. Today, the inspector says that no boilers in the state are in better condition

L D Johnson, Chief Engineer, World's Largest Prison

PROBLEMS

1. **Poor boiler feedwater**
2. **Excessive makeup (about 30%) caused by waste of condensate from kitchen, laundry and industrial steam; lack of condensate storage capacity; faulty steam traps**
3. **Inadequate venting of oxygen and free CO_2 from feedwater in the heater**
4. **Poor combustion of pulverized fuel, causing low CO_2 in flue gas and slagging in furnaces and on water screens**

IN 1928, when the prison's heating system was installed, it was reported to be the largest single-unit hot-water circulating system in existence serving what is said to be the world's largest prison, with capacity for 5534 prisoners. Population is 5300, plus about 548 free employees.

The boiler plant consisted of two 4-drum Heine boilers, rated at 750 hp, each containing 7563 sq ft of heating surface fired with pulverized fuel, supplied by Riley Atrita mills as individual units, and one 4-drum Wickes boiler, similarly rated, with 7536 sq ft of heating surface fired by a Riley 8-retort underfeed stoker.

About the time the Wickes boiler was installed, a similar unit was bought for the old prison, which was overloaded and overpopulated. To allow for cutting and moving the boiler to the new prison later, tubes were 6 in. longer than standard, giving this unit 7720 sq ft of heating surface. The Riley underfeed stoker was identical with the one that fired the original Wickes boiler. In 1935, the boiler was re-erected at the new prison, which thus has four boilers.

Steam at 250-psi gage is superheated approximately 100 F by Elesco superheaters in front pass of boilers. Water is pumped from five deep wells to a common system, with a 100,000-gal gravity tank, 170 ft high, as an accumulator near the power house.

Hot water for domestic use had to be taken from the heating-system mains. As this did not permit summer shutdowns and, in consequence, repairs were difficult to make, a separate circulating system was installed in 1937 to provide domestic hot water.

A sodium-zeolite softener was part of the original installation. We do not know whether the designers intended this softener for the heating system and domestic water only or for boiler-feed makeup, too, but in any case very troublesome priming and foaming occurred when we operated boilers at much over nominal ratings; even then, severe carryover caused frequent superheater failures.

Deposits in piping and turbine blad-

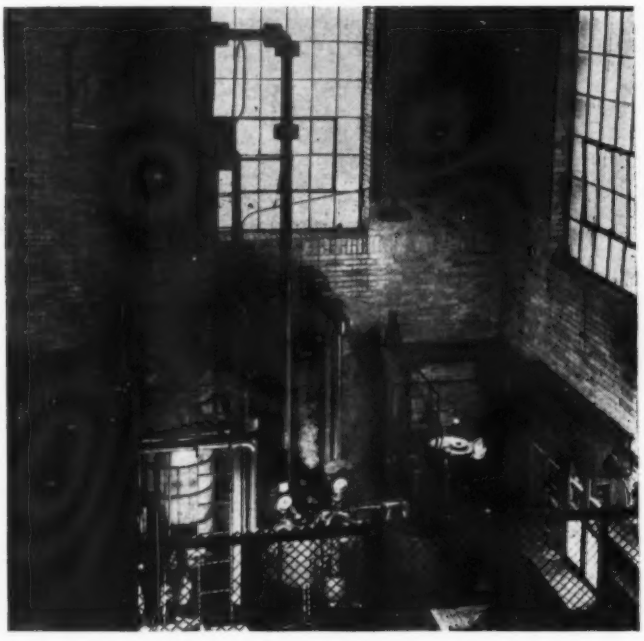


Fig. 1—Corner of plant with hydrogen-zeolite softener in center; proportioning valves and mixing box on top of degasifier; at right, dilute-acid tank under metering pot

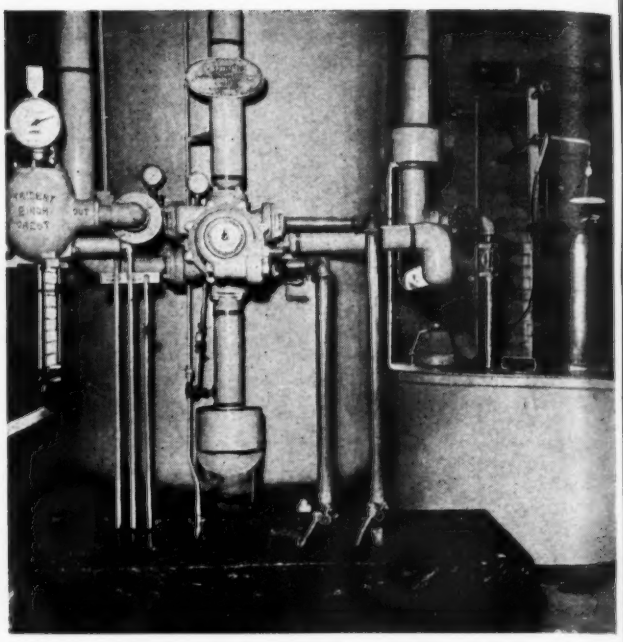


Fig. 2—Closeup of the hydrogen-zeolite softener in Fig. 1; at right, acid-brine tank, automatic backwash valve and sump for carrying off acid after exchange

ing were common. All valves and regulators gave constant trouble from carryover and corrosion. Scaling of boilers was not so severe as might have been expected because most of the solids are not of a bad scale-forming type. But usually it was not possible to keep a boiler in service over 400 hr even at moderate ratings because of high concentrations, dirty deposits in piping, valves and turbine wheels, and because of superheater failures caused probably by carryover and continuous CO_2 corrosion of units.

Study Improvements

As the necessity for improving plant efficiency became more apparent, Cummins & Barnard, consulting engineers of Ann Arbor, Mich., were authorized to make a survey. It reinforced our conclusion that it was almost useless to make improvements looking toward higher operating efficiency unless better water conditions permitted boiler operations at higher ratings; limitation on steaming rates was a bottleneck to any other substantial economy. A moderate sum was made available for the boiler plant and we went as far as possible in licking the worst problems, listed on page 103.

The last problem, poor combustion of pulverized fuel, was corrected by (a) Installation of a new Raymond coal mill; (b) modernization of boilers by addition of water walls and screens, Fig. 3; and (c) enlarging furnaces and installing two burners and automatic combustion control.

Problem 2, excessive makeup, was corrected by comprehensive overhaul of all condensate return lines and traps, and by installation of a storage tank for treated water, large enough to store the rush of condensate at times of peak industrial steam. This change reduced boiler-feed makeup 5 to 10%.

Problem 3, inadequate venting of oxygen and free CO_2, has not yet been entirely corrected because it necessitates a complete shutdown for elevating the closed feedwater heater. The original design placed this heater so low that positive head at suction side of boiler-feed pumps was insufficient to allow feedwater temperature to be carried high enough to deaerate the water properly. If temperature is raised above 212 F, flashing at the impeller entrance jeopardizes feed-pump operation. Plans for raising heater are complete but work has not yet been done.

Problem 1, water treatment, called for considerable thought. Raw water for the power plant comes from five wells and contains an average of 835 ppm of total solids. However, this fluctuates considerably depending on which wells are in service because their total solids vary from 500 to 850 ppm. Chloride content also varies considerably. While the water contains comparatively small amounts of calcium and magnesium sulphates, it is high in bicarbonates and sodium salts. These are potential producers of large amounts of CO_2 in the steam.

Through the consulting engineers, we secured the services of a boiler specialist in a temporary advisory capacity. We installed a hydrogen-sodium-zeolite system because (a) A sodium-zeolite softener was already set up; (b) available boiler-house space was limited; (c) reduction of chlorides was necessary; (d) system offers flexible control of the makeup water's pH value at all times.

Although theoretically this treatment seemed a suitable choice, I hesitated because of inexperience with acid-regenerated softeners. Water might suddenly become acid and produce serious corrosion, and quantities of sulphuric acid in an institution of this kind might involve hazards.

Prisoners Keep Records

The fears proved groundless; all operations, including analyses, are done by prisoners, and *well* done. Detailed records are kept on the acid unit's operation; sodium unit's results are so uniform that it is seldom necessary to alter the ratio—about 60% sodium and 40% acid water—on the proportioning valve.

The system has been in service three years—long enough to indicate future performance. Raw water averages about 835 ppm total solids, of which 379 ppm is bicarbonate as HCO_3, 270 ppm chlorides, with a hardness as $CaCO_3$ of 250 ppm; pH value is 7.2. After treating, bicarbonate is reduced to about 80 ppm; total solids run up to 700 but hardness as $CaCO_3$ is reduced to 6 ppm, and pH value is about 7.8. This water is now only about 10% of

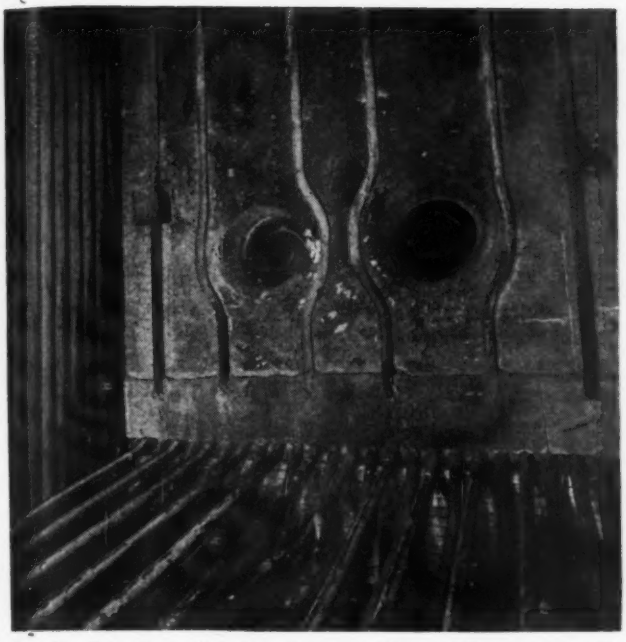


Fig. 3—Interior of boiler furnace after adding waterwalls and screens—one of the changes to remedy poor combustion of pulverized fuel. Burners are in front wall

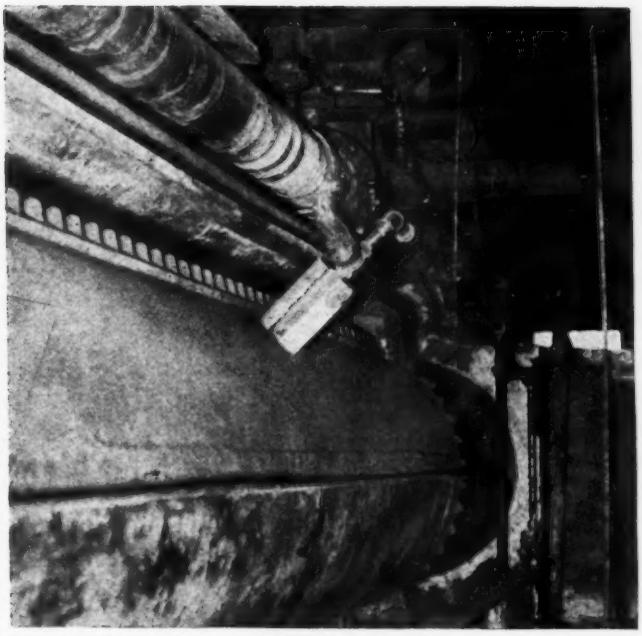
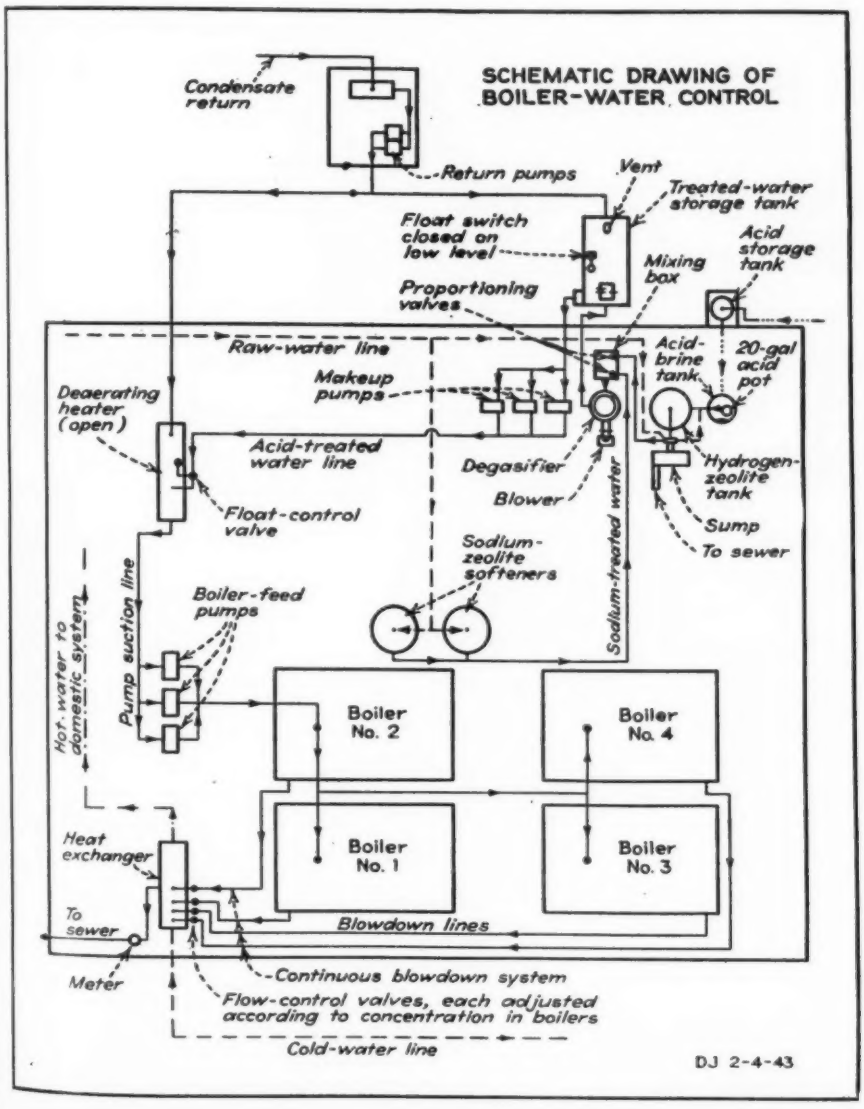


Fig. 4—Continuous surface blowdown taps main drum. Concentrations within the boilers are held to about 2300 ppm by a continuous blowdown of about 38,000 lb daily



total boiler feed, the remaining 90% being returned condensate, Fig. 4.

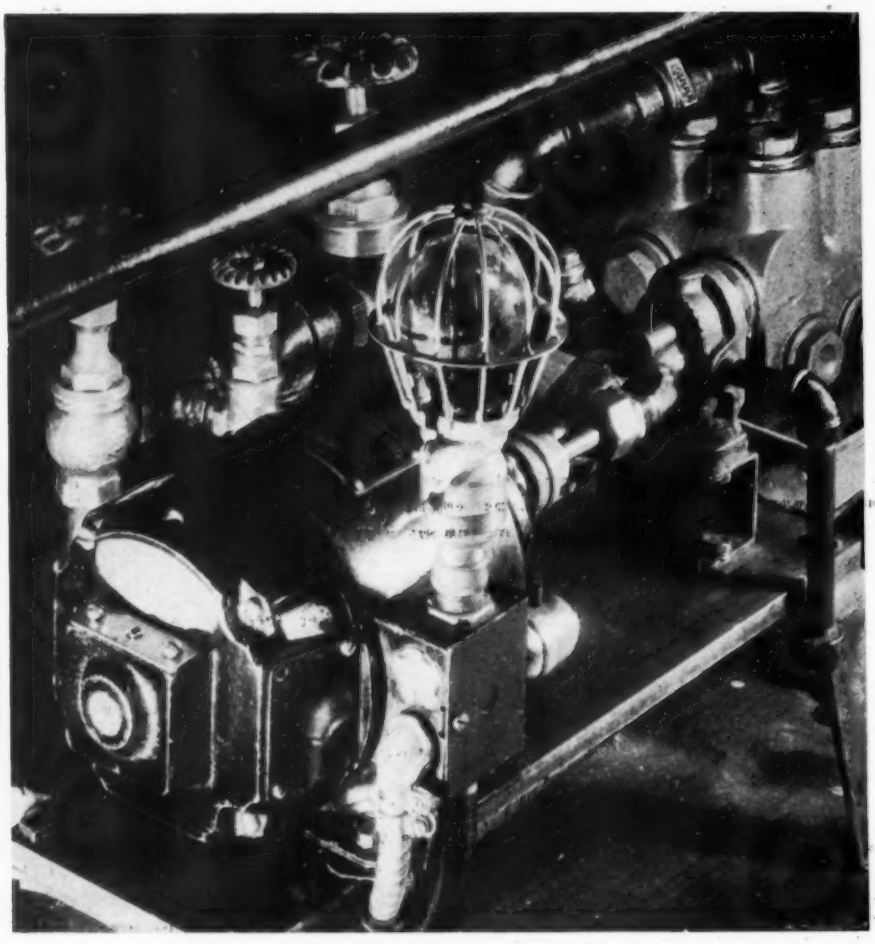
Dry steam is delivered to the superheaters with this concentration, and at steaming rates of about 55,000 to 60,000 lb per hr, approaching 200% rating, the pH value of boiler water is held constant.

We have had no corrosion trouble since the system was installed. CO_2 in the steam has practically been eliminated. Main boiler blowdown valves are opened and closed once only during each shift to insure good condition. A heat exchanger on the continuous blowdown reclaims most of the heat.

Cost of operation was estimated at 25 cents per 1000 lb of steam delivered, based on conditions at time of survey. Actually, average cost of 3-yr operation is 28 cents per 1000 lb of steam generated. Included is equipment depreciation at 10% for an estimated 10-yr life. Of course labor costs are low: two operator-chemists who take care of the hydrogen-zeolite equipment are prison inmates. These costs do not include that for raw water.

Practical results of proper boiler-water treatment are indicated by length of time boilers are kept on the line as compared to previous years. One boiler has been on the line over 8800 hr which is a year's run, and will come off only because of forced-draft-fan trouble. Runs of 5000, 6000 and 7000 hr are common. After a run of this length, a washout with a hose does practically all boiler cleaning. In the last analysis, this tells the story on feedwater.

PRACTICAL AIDS TO OPERATION



Incandescent Lamp Signals Motor Operation

WE KEEP QUITE A CLOSE CHECK on several of the motors in the engine room of the Washington Life Building. In order that the watch engineer will not have to go to the motors to see if they are running we connected a lamp across their armature terminals, as in the photo. All of the motors operate on 120-volt direct current, so that we can use small lamps of that voltage. Failure of power to a motor is indicated by a dark lamp. This will not be true on a polyphase alternating-current circuit, if only one phase opens, which makes it impossible to use this method to indicate single-phase operation of polyphase motors.

New York, N. Y. ALBERT FISCHER

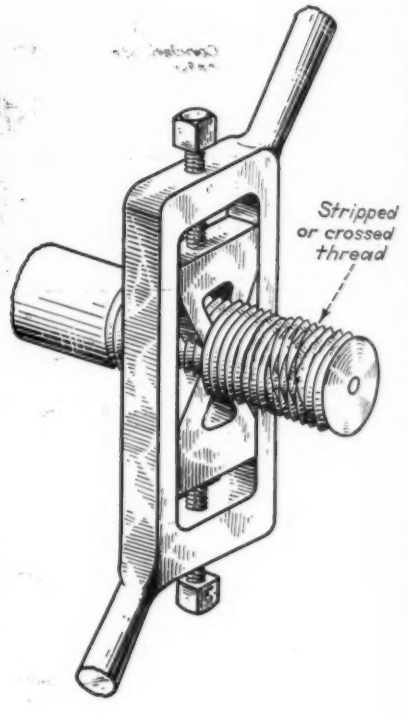
Watch Auxiliary Turbine Oil-Reservoir Level

AUXILIARY TURBINE oil reservoirs are ordinarily of relatively small capacity and are usually provided with sight gage glasses to show the oil level within the storage space. These gage glasses may have valved connections opening into the tank at top and bottom or they may be of an angle-type opening into the tank at the bottom and vented to the atmosphere at the top through a small opening.

Whichever type of gage glass is used, care must be taken to insure its accuracy. When the glass has valved connections at top and bottom it is all too easy for these connections to become plugged or for a valve to be left closed. With the angle type its connection may become stopped up with sludge or its vent plugged with foreign matter. For these reasons, at least once each shift operators should test the reservoirs with a calibrated sounding rod to be sure there is an adequate oil supply.

Failure to observe this precaution may lead to turbine outage caused by lack of oil in the bearings, especially where the machine is left unattended for several hours. A plugged vent on the oil reservoir gage glass of an auxiliary turbine driving a boiler-feed pump in a large industrial power plant recently caused shutdown of the unit because of bearing damage. This vent was stopped up with brass polish so that oil held up in the glass even though the level in the reservoir steadily dropped because of leakage in the oil distribution piping and bearings. Had the reservoir been sounded at intervals this accident could have been avoided.

St. Louis, Mo. O C MILLS



Correct Way to Recut an Old Thread

HERE IS A LITTLE KINK that may be helpful to some of the inexperienced men that are finding themselves in power-plant work. When a thread is stripped or crossed on a bolt don't try to run the die on the thread to straighten it. Place the die on the good part of the thread, as in the diagram, tighten the die in place and then

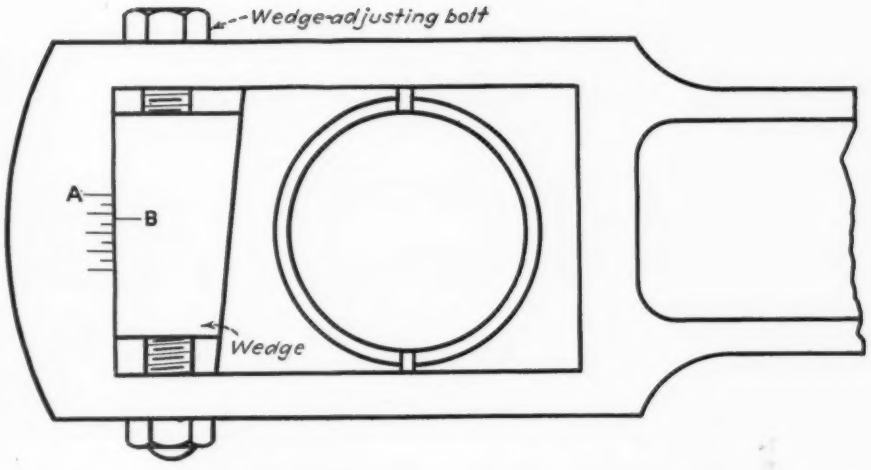
turn it to run out over the thread. This will insure getting the die started right, after which it will trace the thread correctly.

Great Neck, N. Y. S M ELONKA

Graduated Scale Guides Bearing Adjustments

ENGINES, COMPRESSORS and similar machines should have wear taken out of their bearings periodically. We have found it advantageous in our plant for adjustments on the bearings to be graduated so that the engineer has something to guide him. Otherwise, he tries to make measurements from some datum point or scribe lines until on some old machines there are many confusing check lines. To eliminate this we graduated the different adjustable parts. The figure shows the graduations on a connecting-rod bearing wedge.

When making graduations we remove the bearing half next to the wedge and run the wedge to its top position. We



then scribe a line on both yoke and wedge, such as lines *A* and *B* in the figure. Next we turn the wedge bolt one complete turn, tighten it and scribe a second line on the yoke to correspond to the *B* mark, continuing this operation until the wedge is at the bottom. Then these main divisions may be halved or quartered to show ½ or ¼ turn of the wedge-adjusting bolt.

When the engine cannot be taken out of service long enough to lay out the adjusting scale as described, count the threads per inch on the adjusting bolt. Then raise the wedge to its top position and make the initial marks as described above. Next, with a scale mark off the graduations. When the scale has been completed, the engineer has a permanent guide for making bearing adjustments.

Detroit, Mich. NELSON HALL

Hypodermic Syringe Makes Chemical Pump

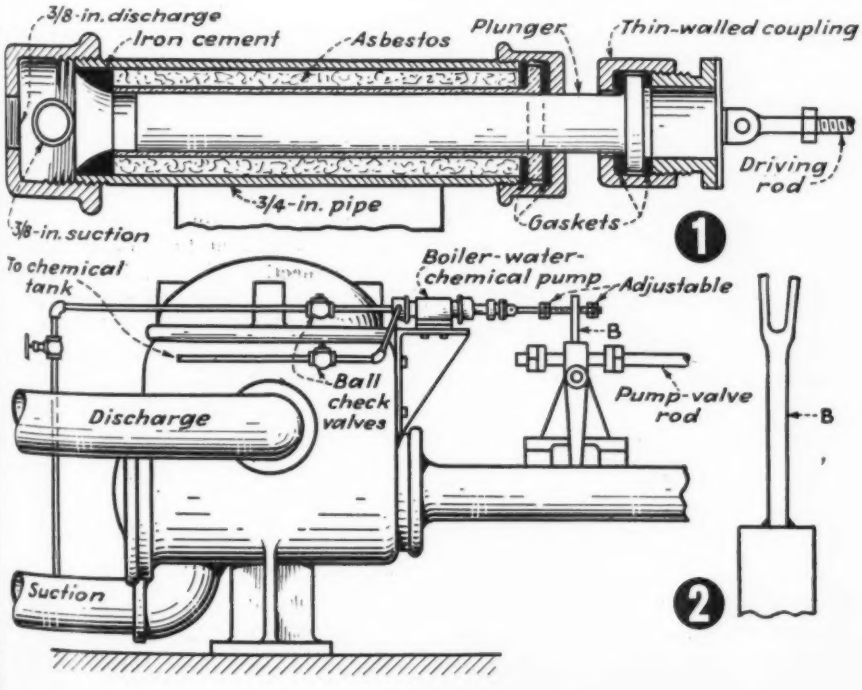
WE NEEDED A PUMP to inject chemicals into our feedwater. As one was not available I got out the old pad and paper to see what could be done about it. When I got through a pump was designed from a 5-cc hypodermic syringe as shown in Fig. 1. I cut off the syringe tip and ground the flange of the barrel until it came within the outside diameter of a ¾-in. pipe.

I then inserted the barrel of the syringe into a length of ¾-in. pipe threaded at each end. With a rubber gasket on each side of the syringe flange it was tightened in place with a pipe bushing. The space between the barrel of the syringe and pipe we packed with asbestos fiber to support the barrel snugly.

To keep the asbestos dry we sealed the end of the barrel to the inside of the pipe with iron cement. To complete the cylinder of the pump I drilled and tapped a hole for the suction pipe in the side of a ¾-in. pipe cap and a discharge pipe hole in its end and screwed the cap tightly on the barrel.

I found that a ½-in. watertight thin-walled electrical coupling with the compressor removed fitted the cap on the plunger and held it firmly. This coupling I cut in two and on the part to be attached to the plunger I brazed a flat plate with a ¼-in. driving rod connection in its center. This driving rod is threaded for two adjusting nuts and is driven by a yoke, *B*, Fig. 2. This yoke is welded to the top of the steam-valve-operating mechanism of the pump, as shown.

We mounted the chemical pump on the water end of the feed pump, as in Fig. 2. Its suction we connected through a ball check valve into the chemical container and the discharge through another ball check valve into the feed pump suction. As the feed

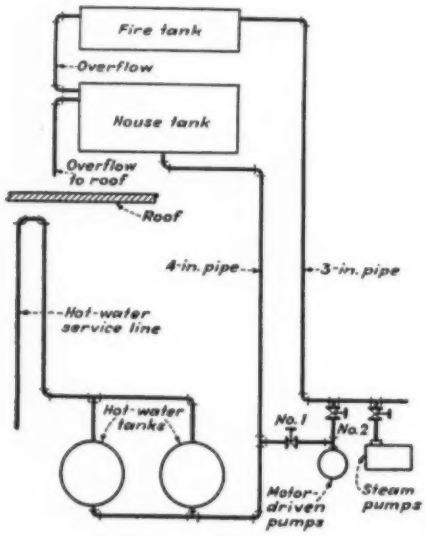


pump is duplex double-acting, the chemical pump discharges once for each four times of the feed pump. which proved to be sufficient for our purposes.

Farmington, Mo. P J GORDON

Cross Connection Increases Pump Capacity

IN THE HOTEL WHERE I WORK water is supplied to two roof tanks by two steam-driven pumps during the heating season, and by two motor-driven centrifugal pumps in the summer time. As

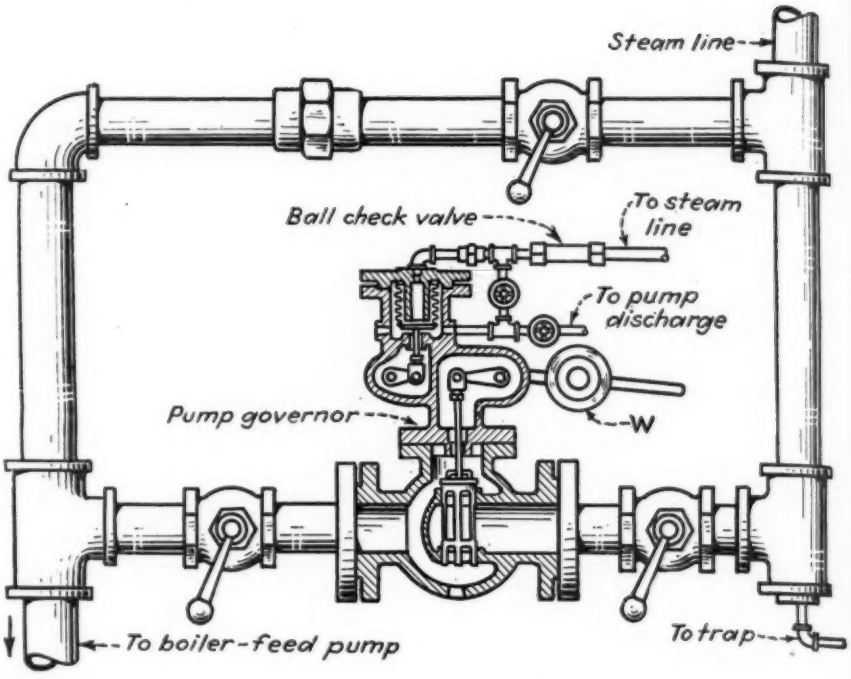


shown in the diagram, water is pumped into a fire tank and overflows into the house-service tank. This arrangement insures that the fire tank will always be full for fire protection.

Because of increased water demands, one motor-driven pump could not supply sufficient water. To eliminate this difficulty I connected the 3-in. discharge line from the pumps into the 4-in. return line from the house tank, as shown. This reduced the head on the pump to where it could easily meet peak-water demands.

Connecting the pump into the return line is a building-code violation, but I have had signs painted at the pump that read: In case of fire close valve No 1 and open valve No 2. In addition to this, once each day during low-water demand the pump is operated to discharge into the fire tank until it is stopped by the float switch in the house tank. This insures that the fire tank is always full. In normal times a new pump would be justified, but now when critical materials must be saved for the war effort, a little violation can be justified to meet a temporary condition.

New York, N. Y. JOHN PLATT



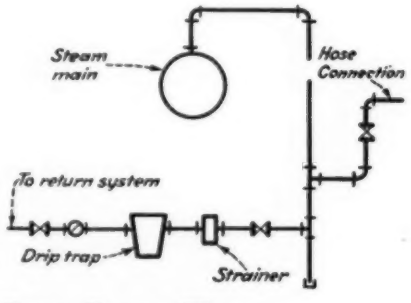
Ball Check Valve Steadies Pump Governor

PRESSURE PULSATION in the steam and water lines of our reciprocating boiler-feed pumps caused a continual movement of the governors, connected as in the figure. Sometime the weight *W* would move up and down three to four inches. This would cause unnecessary wear of the governor so we looked about for some means of eliminating the effects of the pulsation.

As an experiment we installed a ball check valve in a horizontal section of the steam line to the actuating unit of the governor, as shown. This valve practically eliminated all movement of the governor caused by pressure pulsations. Connections to the actuating unit are made with ¼-in. pipe which have small capacity compared to the actuating unit. When the steam pressure drops and the water pressure rises, steam tends to be forced out of the actuating unit by the increased water pressure which compresses the sylphon.

On the outward pulsation of the steam the ball check valve closes to maintain pressure within the sylphon and prevent unnecessary governor motion. Whatever its action, the ball check valve solved the problem.

Fairview, N. J. M N GOZDENOVICH

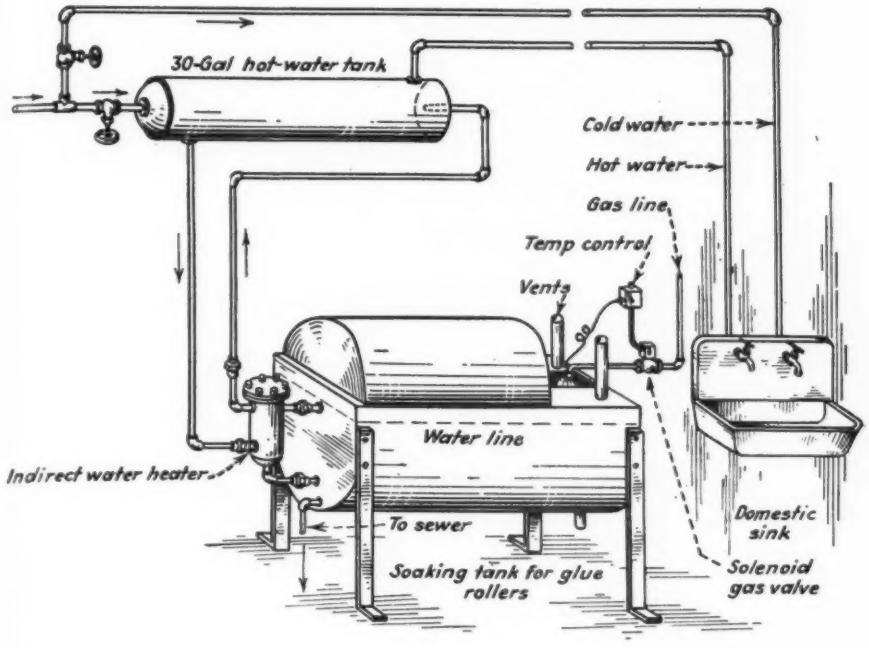


Stop Steam-Hose Valve Leakage

LEAKAGE DRIPPING from a steam-hose connection is common in both boiler rooms and steam-using processing areas of industrial plants. In almost every instance this leakage is caused by the globe valves at the connection not being properly closed or having defective seating surfaces caused by the cutting action of previous leakage.

Such leakage can be minimized and in many cases almost eliminated if these hose connection valves are installed with the pressure on top of the disk. Since most connections of this kind are at the ends of downcoming branches taken from overhead steam mains there is a very good reason for reversing the usual method of installing globe valves.

When such valves are installed in the usual manner they may be tight when first closed. However, as the steam in the drop leg condenses and cools, valve stems tend to contract and pull the disk away from the seat and cause leakage. If the valves are installed with the pressure on top of the disk, contraction may



Heat Exchanger Solves Hot-Water Problem

WHEN WE MADE CHANGES in a remote part of our plant for war production, we were faced with the problem of providing hot water for the employees. As part of the process equipment we had installed an automatic gas-fired asphalt-melting tank for heating water in which brass glue rolls are soaked so that they can be easily cleaned. Temperature of this water is kept at 170 F.

One of the solutions to the sanitary hot-water supply would have been to install an automatic gas-fired water heater. This would have been quite expensive to install and even more expensive to operate. After considering various possibilities we decided to connect a coil-type heat exchanger to one end of the glue-roll hot-water tank as in the diagram. This heat exchanger we connected to a 30-gal storage tank and into the water system as shown.

The whole job was done at a cost of less than 25% of that for an automatic gas-fired water-heater. Even though some extra gas is required in the glue-roll water heater to supply the heat for the sanitary hot water it is small compared to that needed for a separate heater.

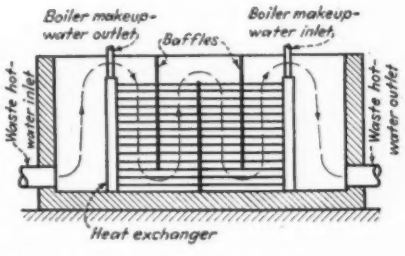
Englewood, N. J. R BOETTINGER

take place but the pressure will hold the disk tightly against its seat.

When valves are installed so that pressure is above the disk their packings have to resist line pressure continuously. It is much easier and cheaper to tighten a packing gland occasionally or even to repack a stuffing box than to maintain valve seating surfaces that are continually giving trouble.

Globe valves may be installed on these connections in the usual manner and will give trouble-free service if the drop leg is provided with a drip trap to remove condensate as fast as it forms. Arrange the piping as shown in the drawing to keep the valve at constant temperature when it is not actually in use.

Lynchburg, Va. O M ROBERTS



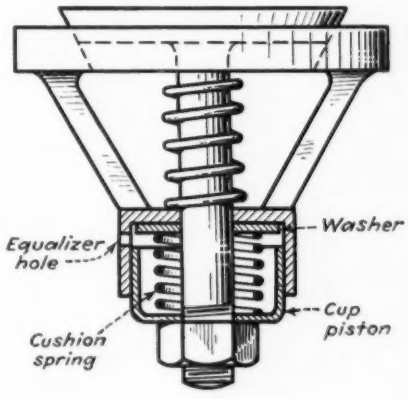
Exchanger Reclaims Heat in Wash Water

IN A LAUNDRY power plant we decided to reclaim some of the heat in the large quantity of hot wash water, thrown to waste. To do this we built a heat exchanger baffled as in the figure and installed it in a large tank. The hot wash water came in at one end and after flowing through four passes formed by the baffles around the tubes went out the overflow to the sewer. The cold boiler makeup water counterflowed through the tubes of the heat exchanger. This device worked fairly satisfactory, but was quite difficult to maintain because of the washing compounds in the water.

Fairview, N. J. M N GOZDENOVICH

Restricts Refrigerant-Compressor Valve Movement

VERTICAL HIGH-SPEED refrigerant compressors equipped with poppet suction valves inclosed in a cage in the piston



may slap when starting, with a small difference in suction and discharge pressure. This condition may be caused by weakening of the cushion spring inside the cup washer, by grit or sludge getting between the cup and its cylinder wall, or by plugging of the equalizer hole in the cushion cylinder.

When a thorough cleaning fails to eliminate the slap, a new cushion spring is required. Take care not to get one that is too strong or, when it is installed, it may cause the compressor to pulsate. If a spring of the correct tension is not available, the opening of the valve may be restricted by placing a washer in the valve cup, as indicated in the figure. I have found that a 40% reduction in the valve opening, such as obtained with a washer $\frac{1}{8}$- to $\frac{3}{16}$-in. thick, does not appreciably reduce compressor capacity.

In an emergency, it may be necessary to drive a compressor with an undersized motor, or it may be desirable to reduce the evaporating surface. When this is done, compressor capacity can be reduced by installing washers under the cup piston to reduce the amount of gas taken into the compressor on each stroke.

Menard, Ill. GEORGE HOLMAN

READERS' PROBLEMS

Questions from Our Readers

Question 1

Testing Shaft Insulation

WE HAVE A LARGE *synchronous motor generator set with the two rotors solidly coupled together and supported by four pedestal bearings. Each bearing pedestal is separated from the main bedplate by one sheet of insulation and several heavy metal shims. All pedestal holding-down bolts are insulated except for a so-called grounding bolt in one inboard bearing. Oil piping and thermocouple conduit from each bearing contain insulated couplings.*

Our usual practice requires removing the ground bolt, and raising the shaft at each bearing before testing its pedestal insulation. Is there any method which will not entail lifting the shaft?

When inspecting the bearings sometime ago we found considerable pitting on the lower babbitt of the inboard ungrounded bearing. On test this bearing insulation was in normal condition.

Why did the electrolysis occur at this ungrounded bearing? Can POWER *readers illustrate some means of overcoming this condition?—OFC*

Question 2

Compressor Piston-Ring Leakage

AIR REQUIREMENTS AT OUR PLANT *have gradually increased until the compressors operate at full load during a considerable portion of the working day. We inspect the automatic valves and keep them in good condition. Since these machines are several years old we think it is possible that the piston rings may be leaking, and causing a reduction in output.*

We understand that ring leakage can be detected by taking a cylinder indicator diagram. Can POWER *readers illustrate how piston-ring leakage changes the compression line on an indicator diagram? Since this line never coincides with the true isothermal or adiabatic line we have been unable to learn much from diagrams.—JG.*

Answers to April Question 1

The Question

Steam Instead of Hot Water

WE RECENTLY INSTALLED *a hot-water tank to furnish domestic water for wash rooms. The tank is piped with heating coils extending about two-thirds the tank length.*

The tank holds 500 gal of water and steam is supplied to the heating coils at 45 psi through a regulating valve.

When the hot-water faucets are opened water flows for about 5 min and then turns to steam. After allowing the steam to blow for about one hour the faucet then discharges cold water.

I have inspected the heater and have been unable to find any steam leaks in the heating coils. What can be causing this unusual condition?—DJM

Lower The Heating Coil

DJM SHOULD INSTALL a thermostatically controlled valve between the coils and pressure-reducing valve as shown in the sketch. This valve should then close automatically at the desired temperature of about 120 F. For better results the coils should be made slightly longer and lowered to about 6 in. from the bottom of the tank. I would also recommend that DJM reduce his steam supply from 45 to 5 psi and install a low-pressure trap.

We solved a problem similar to DJM's by removing the clapper from the check valve in the cold-water supply line. This eliminated high pressures in the hot-water tank because the pressure in the tank simply expanded back through the cold water line.

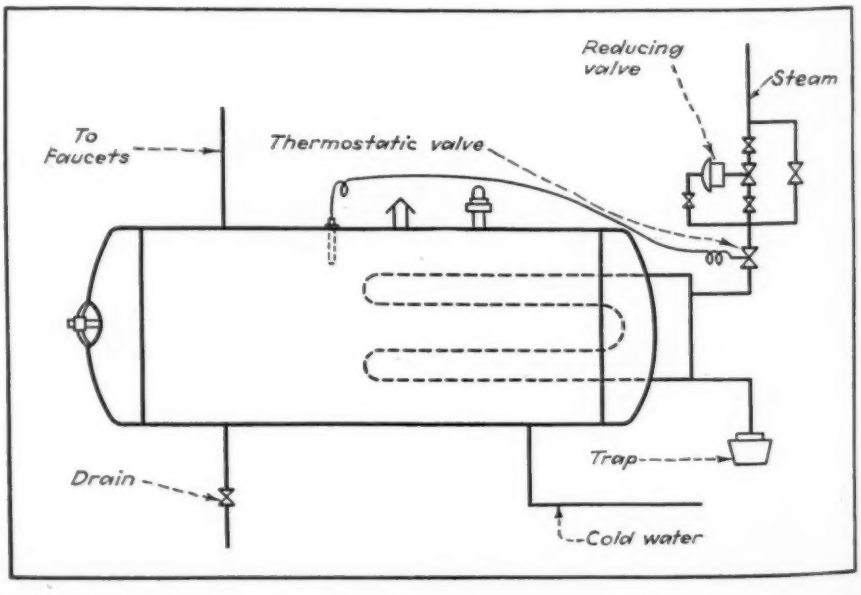
M N GOZDENOVICH

Fairview, N. J.

Poor Circulation

THE DIFFICULTY ENCOUNTERED by DJM seems to be one of circulation. The discharge and water inlet pipes being we must assume properly located with suction out of flash space and inlet pipe so that no stratification is likely to exist. I would suggest a continuous circulation system with a return pipe from each bank of faucets, so that hot water is always present in the manifold bank. This assures hot water immediately without running faucets and precludes stratification within the tank. A small circulating pump would be required for this service.

A steam pressure of 45 psi seems excessive, unless heating coil surface is entirely inadequate. It is the generally accepted practice not to store hot water for domestic use at temperatures above 160 F. Further, water above 140 F generally causes rapid formation of lime and sediment. It would seem that 15 psi would be entirely adequate. This would, steam



coils being wholly adequate, allow a tank temperature of about 140–160 F without difficulty.

F C Marggraff, Jr.
Annapolis, Md.

Use Temperature Control

The results obtained by DJM in the operation of the water heater indicates that four corrections could be made to the installation to make it function properly. These are: (1) Adding a temperature controller; (2) installing an indicating thermometer at the tank; (3) adding a recirculating system; and (4) checking the hot water demand.

The water that comes out first is the water which has remained in the piping between the tank and faucets. After this water has left the piping the steam at the top of the heater enters the piping and flows from the faucets. As this steam leaves the storage spaces it is replaced by cold water.

The temperature controller would prevent the formation of steam above the water. As presently installed there is always steam at 45 psi in the coils. When the demand for hot water ceases the steam in the coils continues to heat the water in the storage space and if the water is not under a greater pressure than 45 psi, steam will form and rise to the top of the storage space.

Baton Rouge, La. G F Matthes

Use Aquastat Control

The predicament stated by DJM shows that the installation of a temperature control valve was overlooked, which is essential for maintaining a constant hot water temperature. The omission of this temperature-control valve is directly responsible for overheating the hot water, and not a steam leak as presumed by DJM. The installation of a hot-water circulating line is desirable and an alteration of the present installation with the above stated suggestion should improve the entire condition.

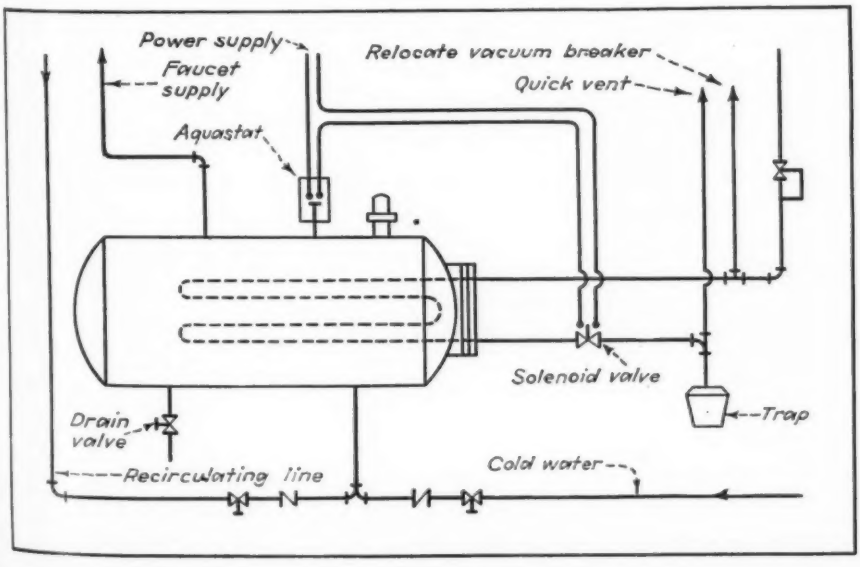
DJM may not be in a position to secure a temperature-control valve, and I should like to offer a suggestion (see sketch) for incorporating an inexpensive temperature-control equipment in his present installation. We installed in our plant a solenoid valve on a booster tank to raise hot-water temperature from 135 to 190 F which during the course of nine months operation was found quite satisfactory.

Carl Bachmann
Schenectady, N. Y.

Inspect Regulating Valve

The unsatisfactory operation of DJM's hot water tank apparently arises from the erratic action of the thermostatic device controlling the steam supply to the tank. The trouble seems to indicate that the *thermostat* or some other part of the *steam control* apparatus is not sufficiently sensitive to respond quickly to gradual temperature changes in the water, but instead this action is delayed until the steam-supply valve suddenly opens wide. The steam coil is evidently capable of boiling the water in the tank under such conditions. In the reverse action no control of the steam is effected until after considerable delay, when it is shut off entirely, allowing the water to cool rapidly.

This trouble might be traced to some other part of the control equipment than the thermostat, such as a bent or sticking stem in the steam-supply valve.



It might also be advisable to reduce the steam pressure supplied to the tank, or to throttle it down where it would just meet the maximum demand for hot water.

I S Chamberlain
Jersey City, N. J.

Check Water Boiling Temperature

As long as the boiling point of the water in DJM'stank is higher than the temperature of the steam there will be no formation of steam, but when the boiling point is lower than the steam temperature then steam will form until the temperature of the water or steam within the tank and the temperature of the steam in the coils are in equilibrium.

The remedy for the present dangerous situation is to control the steam input into the tank with a bellows-type temperature regulator which will cut off the steam when the desired water temperature is reached.

Franklin, Ind. I A Butcher

L-P Steam Not The Answer

The best way for DJM to remedy this condition is to install a thermostat in the tank which will shut off the heating steam whenever the water in the tank reaches a predetermined temperature.

The alternative of merely lowering the pressure of the heating steam would not appreciably affect its final temperature, which is the determining factor. Therefore, if this expedient is resorted to, it may be necessary to install a desuperheater in the steam line between the reducing valve and the tank. This is a simple device which DJM can make easily himself.

Old Bridge, N. J. A J Lubeley

Install Recirculating Pump

In DJM's problem, he should take into consideration the water pressure of his system. He did not give this pressure, but I assume that it must be higher than the 45 psi steam pressure. Therefore a leak in the coil would be a leak or flow of the water into the steam coil and out through the trap instead of a steam flow to the water.

DJM will find that his problem comes from too much steam, instead of leaks. The main trouble lies in the regulating valve and immediate attention should be given to this point. His diagram

does not show an immersion thermocouple in the tank for actuation of the regulating valve. The regulating valve must be actuated by the temperature of the water itself, and the valve should be positive in action.

After sufficient time has elapsed with very little, if any, water being withdrawn and the regulating valve not entirely closing, a continuous, though perhaps diminished, flow of steam occurs, and the temperature of the water within the tank rises abnormally, probably to 250 F or above.

I would also like to suggest that DJM install a recirculating pump, if the cost would not be too high.

Window Rock, Ariz. J F MAHER

Lower The Steam Pressure

THE DIFFICULTIES EXPERIENCED by DJM with his hot-water heater can be traced back to the fact that, if water is heated in a closed vessel under constant pressure, the maximum water temperature that can be obtained without the formation of steam has a definite relation to the pressure in the vessel. In this particular case, the hot water heater is direct-connected to the cold-water supply system and is always under the same pressure.

Assuming that this pressure is 30 psi the maximum temperature to which the water can be heated without the generation of steam is 270 F. As soon as more heat is supplied, steam will begin to form but the water temperature will remain the same because the pressure in the tank is 30 psi.

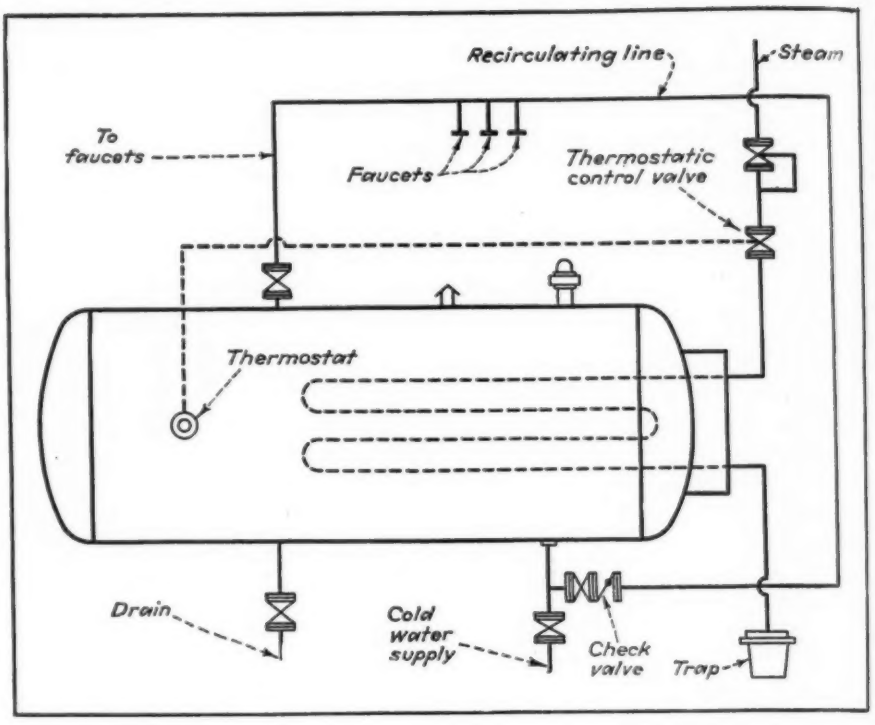
To correct the conditions as stated by DJM, one of the following recommendations might be followed, giving preference to the first:

(1) Replace the steam pressure-reducing valve with a self-contained temperature-regulating valve having a temperature-control bulb installed in the tank; (2) install a cold water bypass around the tank to a thermostatically controlled water mixing valve in the hot-water line; and (3) lower the pressure setting of the present reducing valve till the trouble has been eliminated.

Swarthmore, Pa. H C R FOLMER

Use Vacuum and L-P Steam

DJM'S PROBLEM arises from steam pressure. Steam at 45 psi will, if the water pressure is greater than that, heat the water to about 293 F, the temperature of steam at that pressure.



However, the water in this case is evidently at less than 45 psi pressure and steam is being formed in the tank.

The most satisfactory way to control steam flow is through a thermostatically operated valve controlled by the temperature of water in the tank. If this is unavailable, the steam can be throttled by hand to control the water temperature. A good safety precaution in this case would be to install a safety valve, set at very low pressure, on the steam line between valve and trap.

If DJM has a condenser operating and a source of very low-pressure steam (about 26 in vacuum, and steam slightly above this) he can connect his coils to this system in such a manner that his water will be heated to around 150 F without attention.

Rock Hill, S. C. J C PORTER

Stratification In Tank

DJM'S TROUBLE is caused by the lack of two requirements for the proper operation of a tank for hot-water service. These requirements are (1) temperature control, and (2) provision for recirculation. Although DJM mentions a regulator valve on the steam line, he does not state whether this valve is pressure or temperature controlled. It is assumed, from his diagram, that the valve is a pressure regulator.

The lack of proper control allows the water temperature to rise considerably above the boiling point at atmospheric pressure, depending on the water pressure in the tank. The lack of recirculation causes stratification so that the water at the bottom of the tank remains cold despite the action of natural convection currents. Lack of recirculation also causes the water in the piping leading from the tank to remain cold.

If DJM's system is modified in accordance with the accompanying diagram, his trouble will be eliminated.

New York, N. Y. M N KRAUS

Answers to April Question 2

Must These Boilers Be Replaced?

The Question

WE HAVE IN OUR POWER PLANT, *two 150-hp hrt boilers built in 1909. They have been in continuous use since that time for about nine months of each year, operating at 120 psi. Insurance carriers now decline to permit use of more than 15-psi steam on these boilers because of their age. Thorough inspection has shown no evidence of any embrittlement; there is no active pitting; the flues are in good condition, and all rivets are tight. In fact they are in first-class operating condition but are guilty of the crime of being old.*

Is there any test by which we may

determine possible areas of embrittlement? Are these boilers excessively old for safe operation? May we expect high efficiency at the lower pressure? Are we justified in going to the large expense necessary to change from steam-driven pumps and steam engines for the forced-draft system to motor-driven units with these old boilers? Can we reasonably expect to continue service as usual at 120 psi for two or three years longer until the war emergency is over? The comment of experienced readers on these problems would be very much appreciated?—CJJ

Boilers May Be Lap-Seam Constructed

CJJ PLACES A HANDICAP in his question, when he limits the description to such mere details as 150-hp hrt boilers built 1909 and operated at 120 psi. Because the insurance carriers have cut the pressure from 120 psi to 15 psi, it appears that the boilers are of lap seam construction.

The ASME Power Boiler Code, (1940) Par A-34, says, "Boilers in service one year after these rules become effective shall be operated with a factor of safety of at least 4. Five years after these rules become effective, the factor of safety shall be at least 4.5. In no case shall the maximum allowable pressure on old boilers be increased."

"Par A-35. The age limit of a horizontal-return tubular boiler having a longitudinal lap joint and carrying over 50 psi shall be 20 years, except that no lap-joint boiler shall be discontinued from service solely on account of age until five years after these rules become effective."

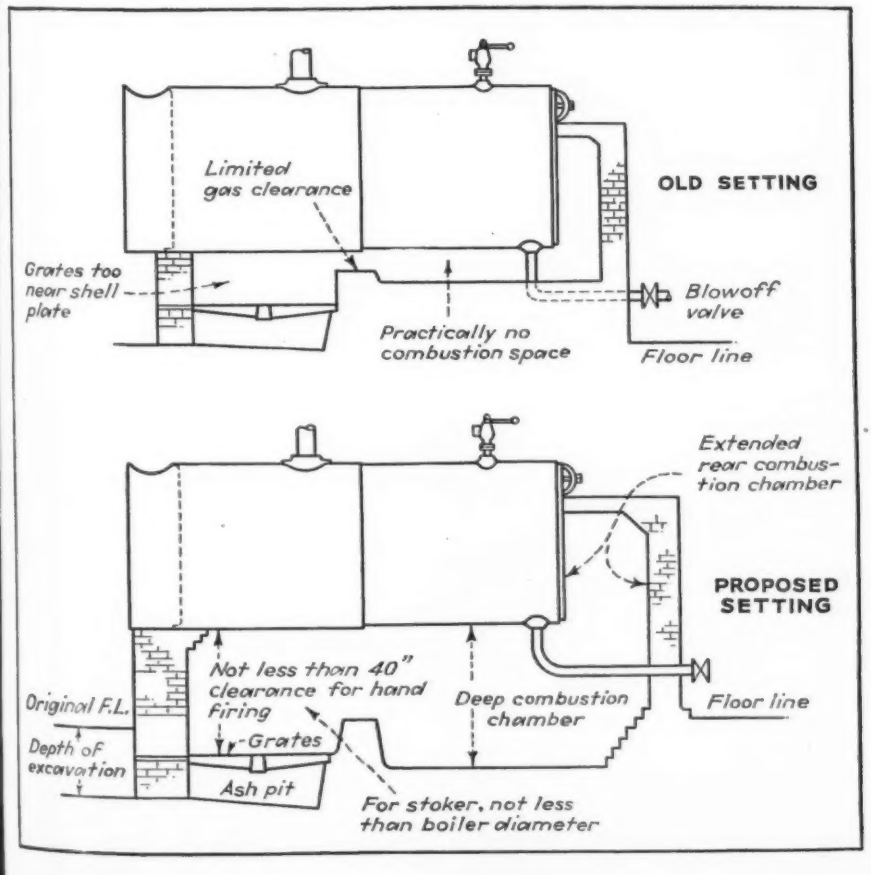
If the boiler is of butt-strap construction, then CJJ should remove the brickwork from around the shellplates and heads to afford as good an inspection of metal as possible. All soot should be thoroughly cleaned from the shell plates, and scale and sludge cleaned from the internal surfaces of the shell and heads. Use emery cloth around the important seams, and places where possible embrittlement may develop. The Magnaflux test may be applied; however, it is unknown whether the Magnaflux can reveal cracks that may occur from laminations in the plate unless several rivets are removed to permit inspection of the rivet holes. If this should be done there will be a possibility of the Magnaflux revealing hairline cracks on the rivet hole surfaces or the rivet hole walls.

After removing all brickwork, CJJ could apply a hydrostatic test of 135 psi. It is preferable not to strain the old boiler by applying an excessive test pressure. The test should be applied in the presence of a commissioned boiler inspector, or state inspector, who should test the condition of the plates with hammer blows at vulnerable spots.

If the boiler is of butt and double-strap construction, and stands the hydrostatic test satisfactorily at 135 psi, then it should be good for at least 110 psi steam.

The condition of the plant must be considered before efficiencies can be discussed. If the boilers are used for heating purposes, then 15 psi could be carried providing that a good vacuum return could be installed in the heating system. The amount of fuel burned depends greatly on the boiler setting, and if the setting is the same as when the boiler was installed, then it should be rebuilt, increasing the furnace volume, and also that of the combustion chamber. If the boilers can be raised; so much the better; if they cannot, then the ashpit and combustion chamber floor can be excavated as shown in the sketch.

Grand Rapids, Mich. J M GORRIE



Consult Another Insurance Carrier

TO CORRECT ANY INFERENCE that insurance companies would issue blanket refusal to carry over 15 psi on a boiler merely because it became 34 years old, it should be pointed out that the question is misleading indeed.

A sliding scale of maximum allowed pressures, based on increased factors of safety as the years advance, is customary. To reduce suddenly the allowable pressure from 120 to 15 psi speaks loudly of a condition entirely overlooked or unknown to CJJ.

Whether it be embrittlement, overheating, corrosion or some other pronounced defect is not clear—but defect there is, of that CJJ can be quite sure by the drastic cut in pressure.

Operation of a defective boiler at high pressure, after due warning by expert opinion, might well be considered criminal. The war effort would be helped not one bit by a boiler explosion even though it were caused by patriotic but ill-advised persons.

Another insurance company might be called in for consultation, giving them all known facts and experience so that the situation would not be one of blind competition for business but one of engineering decision.

If the boiler is in a Code state an appeal may be directed to the State

(*Continued on page* 156)

BOILER QUESTIONS & ANSWERS

By HARRY M SPRING

"Boilers: Safety, Definitions, Firetube Types," the April installment of Alex Higgins "Q and A" series, presented five cross-sectional drawings to illustrate distinctive features of four types of watertube boilers. In Mr Higgins' manuscript they were submitted as simplified sketches, intermediate in character between engineering drawings and diagrammatic sketches. Redrawing these sketches in sharp style for publication unfortunately gave them the appearance of engineering drawings intended to be taken at face value in all details.

Some readers have judged the published drawings on that basis, for they have criticized in minute detail certain variations from ASME Code requirements or other accepted practice. For example, one critic stressed the fact that two of the boilers pictured did not follow the Code in the matter of pressure-gage fittings. Mr Higgins had already fully covered these fittings in his manuscript detailing certain boiler attachments for future publication.

Of the various comments received the most detailed came from Harry M Spring, well-known specialist in boiler inspection and ASME Code applications. To set the record straight, we have offered Mr Spring the opportunity to present his own drawings of these same boiler types with particular emphasis on those details covered by ASME Code or other accepted practice. Mr Spring also gives here his preferred answers to certain questions, originally asked and answered by Mr Higgins, using the numbering in the April issue for convenient reference.

Remember that Mr Higgins has long known many of the constructions and arrangements here recommended by Mr Spring, and had amply covered them for future installments of this series, manuscript for which we received some time ago.

Mr Spring's comments, therefore, are not necessarily out of line with Mr Higgins' own views on many of the points covered. However, publication at this time may help cancel any impression that the April sketches can be used as a safe guide to requirements of construction details.

Finally, note that some of Mr Spring's comments relate to matter of fact, others to matters of opinion on which experienced men may properly disagree.—Editor.

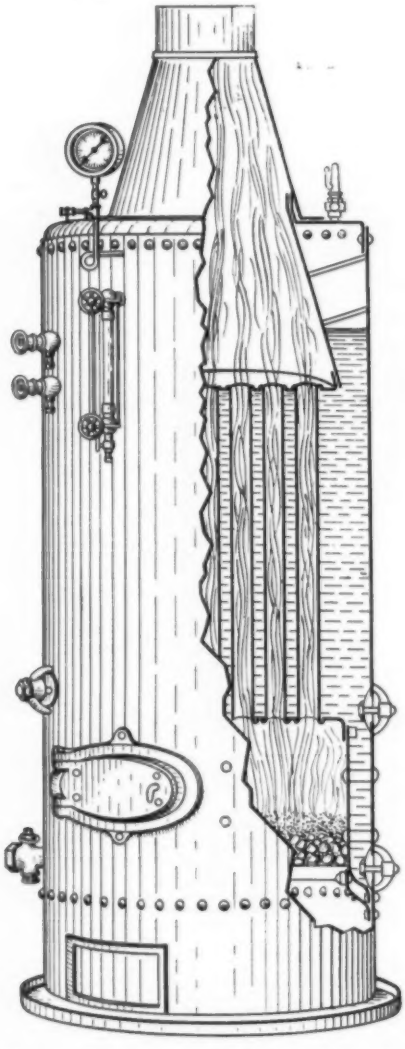


Fig. 1—Wet-top vertical firetube boiler.

Q 2—How would you get a boiler ready for inspection?

A—Cool the boiler slowly. When cool, drain it through the blowoff line, venting it through a suitable valve above the water line to prevent vacuum from interrupting free drainage. When the boiler is drained, remove manhole and handhole plates; wash loose scale and sludge from internal surfaces. Blow or brush all external surfaces clean of flyash or soot. Clean out furnace and combustion chamber. Have at hand necessary tools, clamps and fittings for valve or gage adjustments. If the boiler is in battery with others under pressure, be sure that all steam, water and blowoff valves cannot be accidentally opened while men are in the empty boiler. Have sufficient help at hand in case removal of any brickwork will facilitate the inspection.

Q 3—How would you assist the boiler inspector during his inspection?

A—Give him all the help he needs in making his inspection. Point out any known defects. Station someone immediately outside the boiler when he is making his internal inspection; make sure, if the boiler is in battery with others, that all steam, water and blowoff valves are locked shut or otherwise secured so that they cannot be accidentally opened. Make provision for hydrostatic test if the inspector deems it advisable, and in general assist in every way to make his examination thorough and complete.

Q 4—What action would you take on discovering a defect in the boilers or

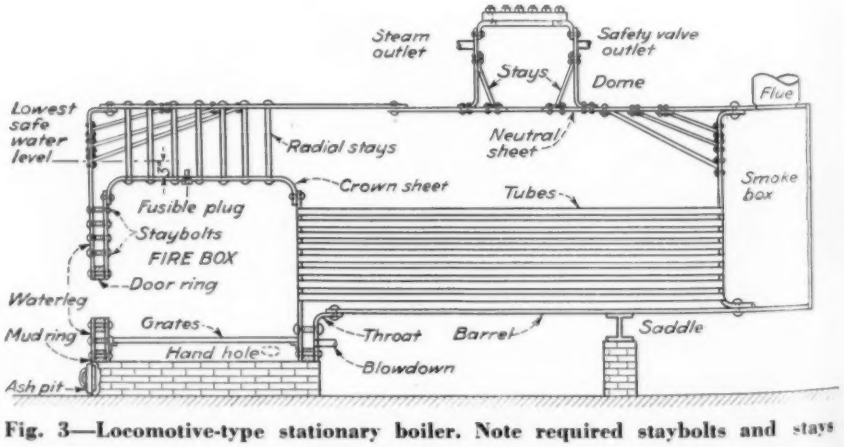


Fig. 3—Locomotive-type stationary boiler. Note required staybolts and stays

Answers to Many Pushbutton Control Problems

Cutler-Hammer's New Wide Range Line of Heavy Duty Pushbutton Stations offers an Unlimited Variety of Functional Combinations

● Now Cutler-Hammer offers a new line of Heavy Duty Pushbutton Stations (NEMA Type 1) for surface mounting and for flush mounting. The surface mounting enclosures accommodate from 1 to 8 Cutler-Hammer new unitized pushbuttons; the flush mounting constructions accommodate from 1 to 3 C-H unitized pushbuttons. The line provides the widest selection of functions and combinations available today and permits these stations to be "tailored" to your exact needs.

Among the many advanced engineering features are the following: one to 4 circuits for each pushbutton; wide variety of operators; big buttons for gloved-hand operation; projecting shatterproof color caps for 180° visibility; fitted "flange-seal" covers for extra sturdy and tight enclosure; rugged yet light weight construction; ample internal free space for easy wiring despite small size; no sharp corners or edges; excellent appearance; optional padlocking feature. Stations may be mounted horizontally or vertically. Write for further details today. CUTLER-HAMMER, Inc., 1358 St. Paul Ave., Milwaukee, Wis. *Associate:* Canadian Cutler-Hammer, Ltd., Toronto, Ont.

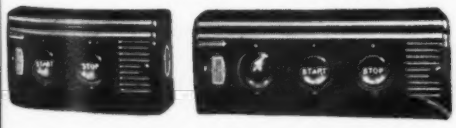
ARMY E NAVY
Milwaukee Plants.

SOME OF THE OUTSTANDING FEATURES OF THIS LINE

Wide choice of operating elements with one to 4 circuits each, indicating lights, selector switches, etc.

Plain Pushbutton — Indicating Light — Selector Switch

Latch-Safe Switch — Maintained Contact — Mushroom Head for easy operation



Horizontal as well as Vertical Mounting

Fitted Flange Seal Covers — Ample Wiring Space despite Small size — Padlocking Arrangement Available

CUTLER-HAMMER
MOTOR CONTROL
C-H

BOILER QUESTIONS AND ANSWERS

(Continued from page 114)

engines under your charge?

A—If there is any question about a defect, notify the boiler inspector immediately by telephone or telegram. Shut the boiler down until the nature of the defect is determined and remedied. If it is obvious that the defect is minor in extent, notify the boiler inspector and receive his approval of contemplated repairs.

Q 5—What should be your first duty on taking over a shift?

A—Observe the water level in the gage glasses of all boilers. Blow down the water column and gage glass on each boiler and observe return of water to the glass. Check level with the gage cocks.

Q 8—What is a steam boiler?

A—(Quoting from the ASME Code for Power Boilers, 1940) "A pressure vessel in which steam is generated by the application of heat resulting from the combustion of fuel (solid, liquid or gaseous) shall be classed as a fired steam boiler.

"An unfired pressure vessel which generates steam for power or heat to be used externally to itself shall be classed as an unfired steam boiler."

Q 12b—In connection with steam boilers what is meant by fire line?

A—Fire line is the highest point of the heating surface contacted by radiant heat of the fire.

Q 16—What is the difference between a tube and a flue?

A—Both are cylindrical tubes but the term, tube, is usually applied to those of small diameter, up to about 6 in. Over this diameter, they are called flues. Note that the tube sizes refer to *outside* diameters. Fire tubes in railroad locomotives are commonly called flues regardless of size.

Q 18—Describe the vertical dry-top boiler.

A—This is a vertical internally fired firetube boiler, consisting of a vertical cylindrical shell containing the internal furnace and a comparatively large number of small-diameter firetubes. Radiant heat from the fire is absorbed by the furnace sheet and the lower tube sheet. Hot gas passes upward through the firetubes giving up part of the heat to the boiler water.

The upper tube sheet is dry because the water level is normally only two-thirds of the length of the tubes above the lower tube sheet. Old-time operation, still practiced sometimes, was to fill the boiler with water when starting a fire and to blow down the boiler to normal operating level after steaming temperatures were reached. This prevented overheating and leakage of the upper expanded ends of the tubes.

Steam from this type of boiler is often slightly superheated as the upper third of the tubes is dry.

This type of boiler is often used for portable equipment and has found a place in small stationary plants having limited floor space but plenty of headroom. Sizes range up to about 300 hp (3000 sq ft of heating surface) and for pressures up to about 200 psi.

Q 20—What are the advantages and disadvantages of vertical firetube boilers?

A—Advantages are: (a) Minimum floor space per boiler horsepower; (b) comparatively low first cost; (c) little or no brickwork setting required; (d) the boiler in smaller sizes may be semiportable because of item (c); (e) tubes all one size—one tube for a spare being sufficient for any replacement.

Disadvantages are: (a) Internal surface not readily accessible for cleaning or repairs; (b) limited water capacity may cause fluctuating pressure under variable load; (c) wet steam not unlikely under sudden peak loads; (d) design lends itself to high stack temperatures with limited efficiency; (e) fixed dimensions of internal furnace may discourage change in fuel; (f) limited fur-

(Continued on page 166)

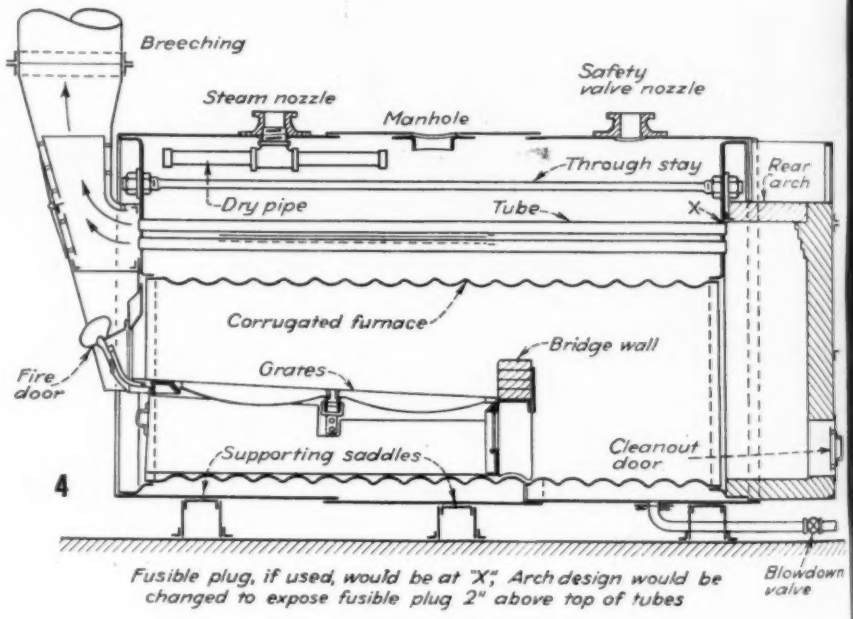


Fig. 4—Dry-back marine-type boiler

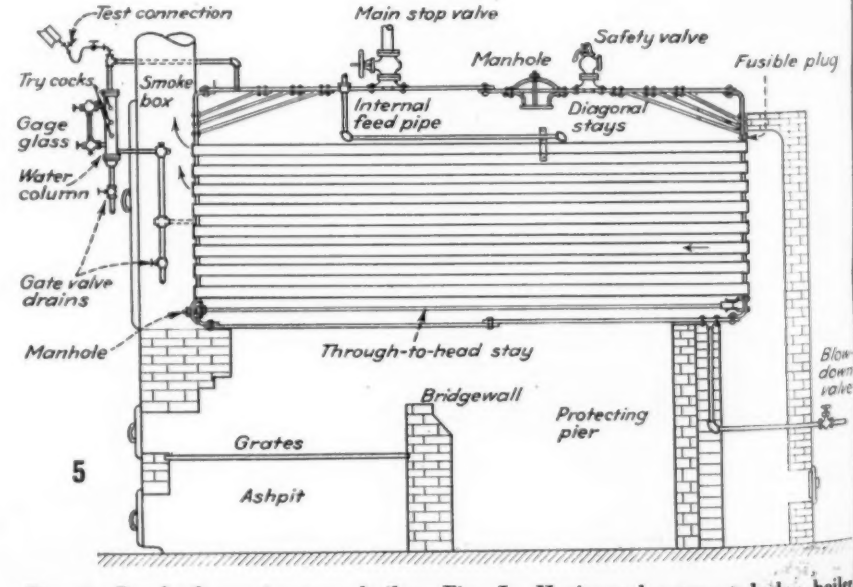


Fig. 5—Horizontal return-tubular boiler

Cluett-Peabody Also Knows

"What the Well-Dressed Condensate Line Should Wear"

"FOR the three years since installation, Yarway Impulse Traps have given no trouble and have kept our equipment hot at all times."

That's what the famous makers of Arrow Shirts and Collars say about Yarway Traps at their Atlanta, Georgia, plant, where 42 Yarway Impulse Traps and Strainers are in service on special ironers and fusing machines made by the Prosperity Co.

More than 200,000 Yarway Impulse Traps have been sold to *get equipment hotter, sooner—to keep it at peak performance* for maximum efficiency and economy.

Why don't you standardize on Yarway Traps for the same reasons, and for their *lower installation cost*, for their *maintenance savings*, for their *savings in valuable floor space?*

You probably can *install Yarway* Impulse Traps *in your plant for the cost of repairing ordinary traps.* See your Mill Supply House. More than 100 dealers are ready to supply you—or write for Catalog T-1737.

YARNALL-WARING CO., 100 Mermaid Ave., Philadelphia

YARWAY IMPULSE STEAM TRAP

REFRIGERATION NOTEBOOK — 3

Regular Purging Trims Power Costs to the Bone

By **TERRY MITCHELL, ME,** ***Frick Company***

THE FOUR SOURCES of foul gas in a refrigerating system are corrosion, the breakdown of oil, the decomposition of refrigerant in contact with impurities, and air drawn in under vacuum operation or during maintenance work. The shameful waste of power from accumulation of foul gas is shown in the head-pressure table, right. Yet thousands of plants run with 15 or 20 psi extra head pressure because engineers tend to put off purging by the old-fashioned method, involving as it does excessive waste of ammonia or Freon-12 and loss of operating time.

Modern Purgers

All this highlights the value of the modern purger, which collects noncondensable gas in a small drum, inside of which is a coil or finned pipe kept very cold by direct expansion. Ammonia or Freon gas entering with the air is condensed by the low temperature and falls to the bottom as a liquid. A sight glass in the purger shows when the accumulation of foul gas is sufficient to blow off. It usually collects over a period of many hours and can easily be vented by hand, as well as automatically.

The cooling element in the purger should be connected to the coldest suction line available. Purgers having the liquid space connected to the bottom of the receiver work with full head pressure inside the purger shell; the refrigerant then condenses out most completely and is most easily drained.

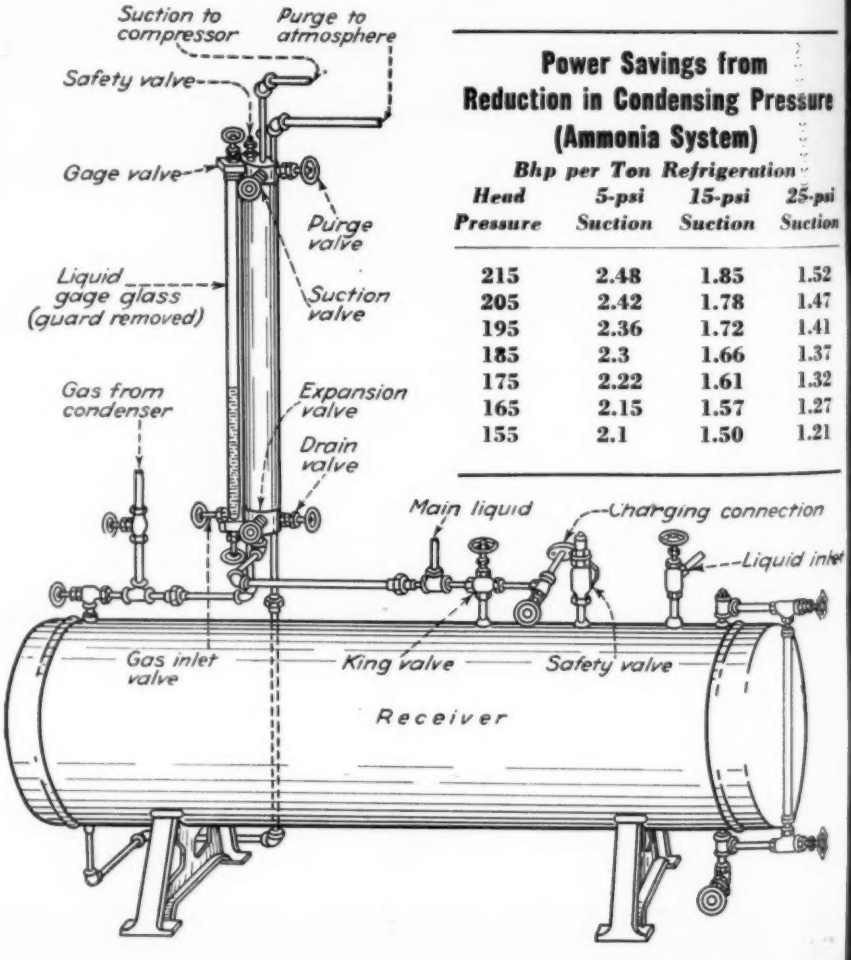
Always place the purger above the receiver, as in the sketch, and connect the gas pipes to both receiver and condenser. Valves should permit purging from either vessel independently. Bleeder or flooded condensers require a separate equalizer line between top of stands and top of receiver.

In older styles, operating valves sprawled all around the purger. In the newer ones, the valves are mounted directly in the thick steel heads of the drum. Purgers are built in large and small sizes; choice depends on operating conditions and the amount of foul gas encountered, rather than plant capacity.

The purger must be kept thoroughly chilled when in operation. Otherwise, warm ammonia or Freon gas remains in the vessel and the appearance of the glass deceives the engineer into thinking that a lot of foul gas has collected, ready to blow off. The gas-inlet valve need be opened only about one turn, while the expansion valve is merely "cracked." Suction and drain valves, as well as those on the gage glass, are opened wide. Stripes painted slantwise inside the glass guard make it easy to see the level of the liquid. When viewed though the fluid, the stripes are distorted and appear more horizontal.

If you cannot buy a purger, it is possible to have one built locally although the cost may be high. But even though the job has to be done the old, slow way, keep foul gas out of the system. In making repairs or placing a new plant in service, remember that it is easier to prevent the entrance of air than to remove it by hand purging.

The table below shows that an ammonia plant, operating with a suction pressure of 15 psi and a head pressure of 215 psi, uses on the average 1.85 bhp per ton of refrigeration produced. If head pressure is lowered to 185 psi by means of a purger, hp is reduced to 1.66, a saving of 0.19 hp per ton. Operating without a purger thus increases power cost by 11.45%. The wastage of refrigerant is equally important.



Arrangement of connections for the unit-type purger: Always place purger above receiver and connect gas pipes to both receiver and condenser

Power Savings from Reduction in Condensing Pressure (Ammonia System)

	Bhp per Ton Refrigeration		
Head Pressure	***5-psi Suction***	***15-psi Suction***	***25-psi Suction***
215	**2.48**	**1.85**	**1.52**
205	**2.42**	**1.78**	**1.47**
195	**2.36**	**1.72**	**1.41**
185	**2.3**	**1.66**	**1.37**
175	**2.22**	**1.61**	**1.32**
165	**2.15**	**1.57**	**1.27**
155	**2.1**	**1.50**	**1.21**

SOLNUS OILS

"eliminate high oil consumption . . sludge formation . . frequent overhauls"

Today, municipal equipment in defense areas is carrying "plus loads" that were never even dreamed of yesterday. Engines run longer, carry greater loads and need the right lubricant more than ever before.

The value of engineering "know how" plus the right lubricant was proved recently in a large pumping station in New England. The Winton Diesel engines—source of power for centrifugal pumps—were plagued with bad sludge formations, frequent overhauls and high oil consumption. A Sun Oil Engineer—one of those Doctors of Industry—studied the situation, recommended a change from a competitive lubricant to Solnus Heavy Medium Oil and that proved to be the answer!

Trouble stopped! According to latest reports all parts are perfectly lubricated . . . there are no carbon formations . . . engines are free of sludge . . . oil consumption is at a new low . . . and there hasn't been a replacement or overhaul since Solnus Oils were placed in service.

This is just another one of many cases that are constantly proving the value of these modern diesel lubricants and Sun Service. Both are yours to use to help keep your plant on a "victory schedule." Write for more information today . . .

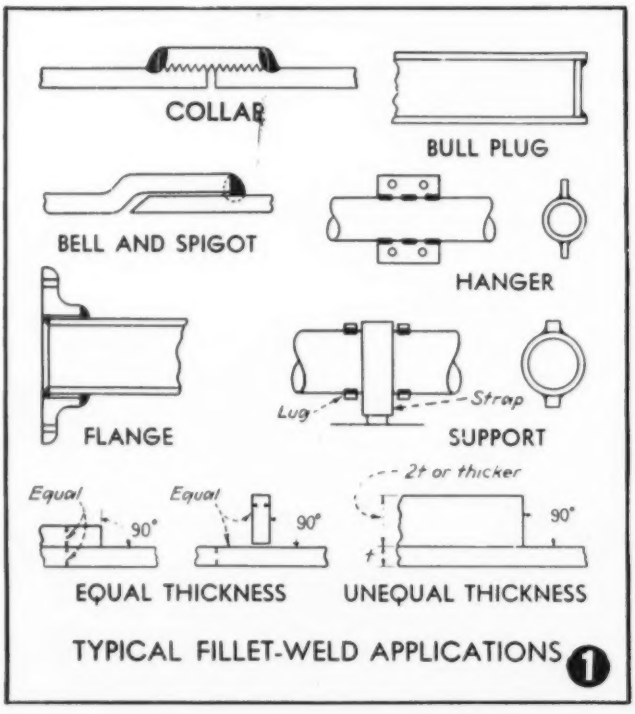
SUN OIL COMPANY · *Philadelphia*

Sun Oil Company, Ltd., Toronto and Montreal, Canada

SUNOCO

SUN INDUSTRIAL PRODUCTS HELPING INDUSTRY HELP AMERICA

HOW TO LEARN TO MAKE FILLET WELDS

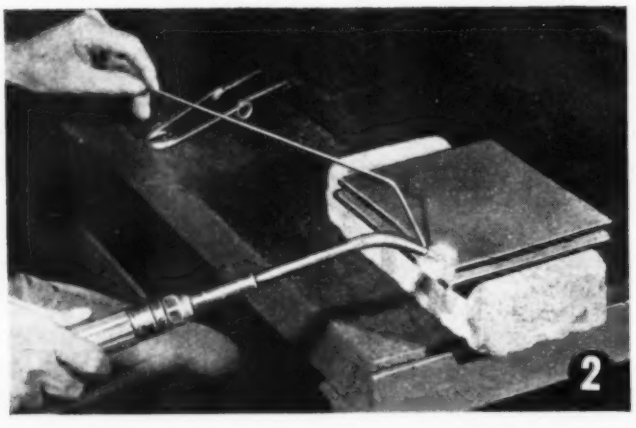


TYPICAL FILLET-WELD APPLICATIONS 1

This is the third of a series teaching the basic elements of pipe welding, for beginners and for experienced welders who want to break in new men. Refer back to April POWER, *(page 126) for list of materials and preliminary instructions. Pictures and data by courtesy of Linde Air Products Co.*

1 Fillet welds find wide use in pipe welding and general power-plant work; the drawing shows typical applications

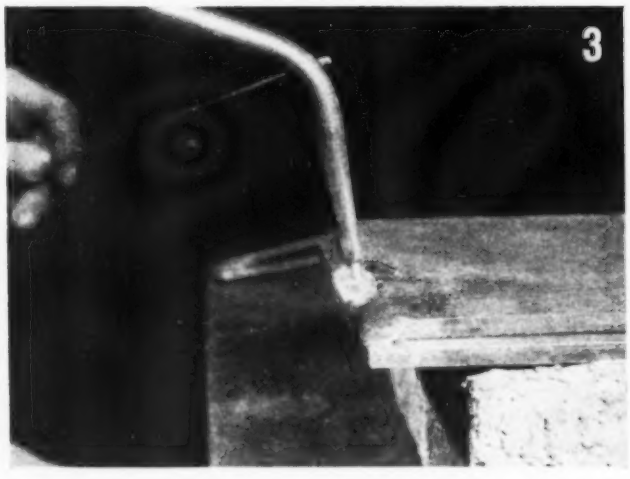
2 Use pieces of ¼-in. plate for practicing fillet welds before attempting them in pipe. Place one plate upon another, but ⅜ in. off center, as shown in photo. This forms a shelf for a fillet weld on each of the four edges. Make the first weld in a downhand or flat position, using a Purox No. 5 head, or equivalent size if another make is used, and ⅛-in. welding rod

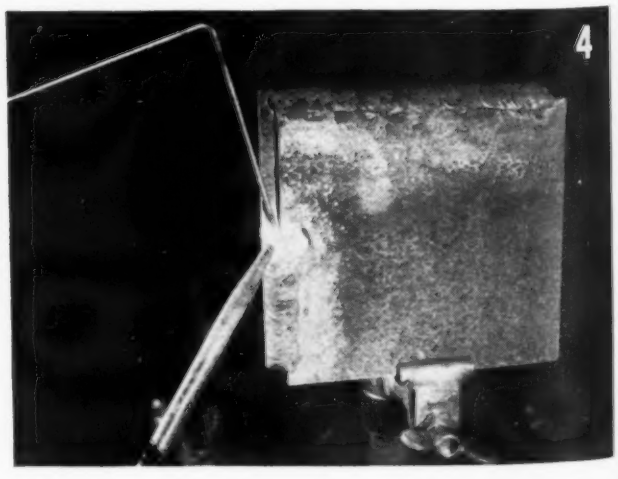

2

3 Start at one corner and heat the two edges to a dull red for about an inch; concentrate most of the heat on the lower plate. Radiation heats edge of upper plate—in fact, it will get too hot if care is not taken, and will melt down before the metal in the lower plate is molten. Be sure lower plate is heated clear back behind the edge; otherwise, complete fusion is not obtained at the weld root. When bottom of weld has been closed, introduce rod and fill up joint to form a triangle of weld metal. Continue alternately to close about an inch of the root with a light weld and then fill in with rod to finished size. You will find the entire operation similar to making a weld in pipe or plate with edges beveled 45 deg on each side

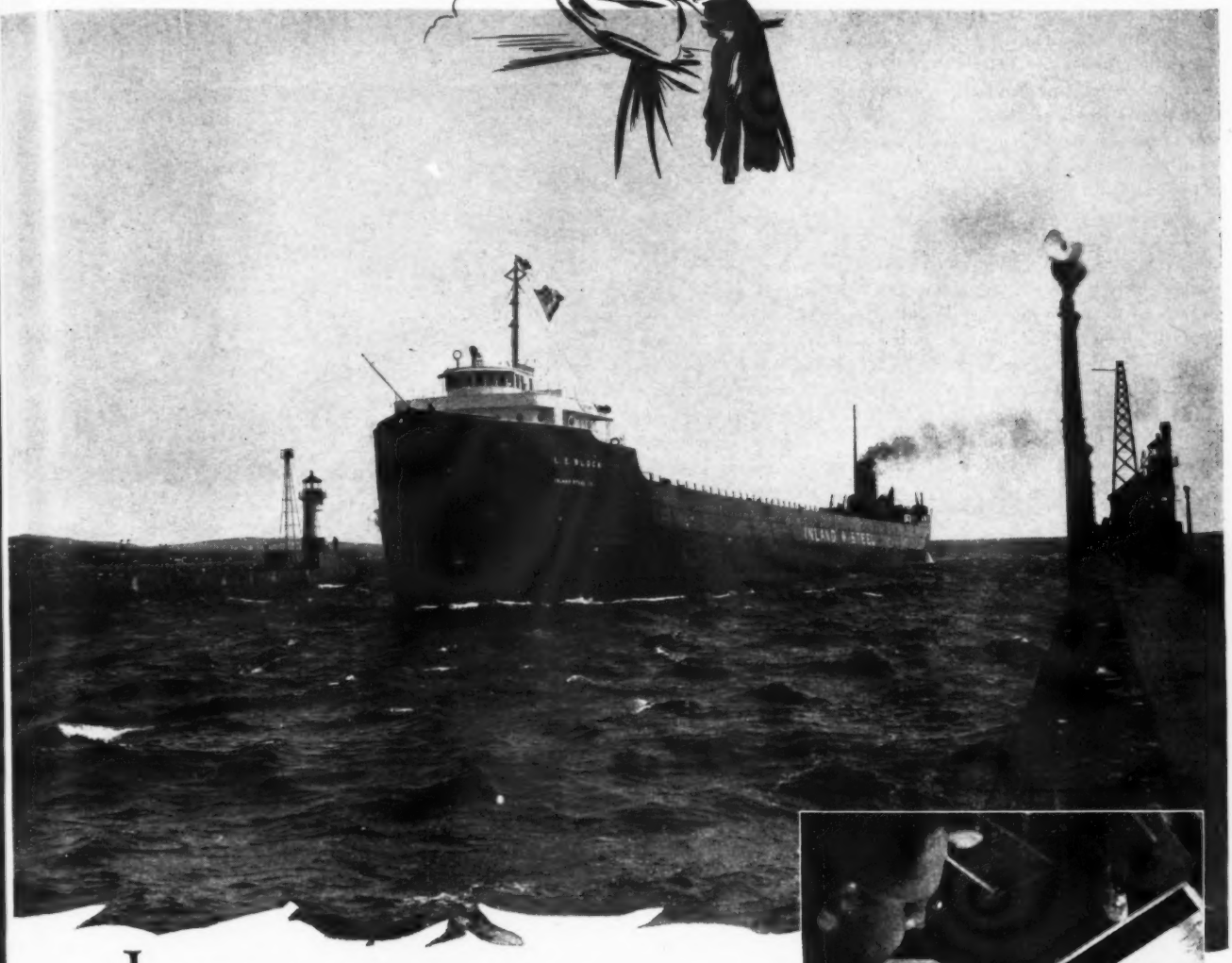
4 Take the two pieces that have just been welded together and clamp them in the rig so that plates are vertical, with finished weld at top. Then make a vertical on the edge at left, using a Purox No. 5 head, or its equivalent if another make is used, and ⅛-in. rod. Start at the bottom and weld up, pointing the blowpipe flame upward to help control the molten metal. Note that rod and center line of flame form a 90-deg angle. As with the flat fillet weld, be sure to heat underneath the edge to get thorough fusion of base metal in the weld root

(*Continued on page* 122)


3


4

FLOATING BOILERS *Can't take time out!*



INLAND Steel Company's big Steamer L. E. Block is a record setter on the Great Lakes, having established in 1942 a mileage record in 38 trips of 61,887 miles. She had to keep steaming to make such a record and Nalco in her boilers helped her do it.

The fact that the L. E. Block's skipper and engineers, like approximately 80% of all the operators on the Great Lakes, rely on the Nalco System is a good guide for industrial plant engineers. Outages of marine boilers are a real crisis; so are outages in your plant. The Nalco System will end scale, corrosion and carryover for you.

In the world's finest water treatment laboratories, Nalco successfully solves thousands of industrial water problems annually. These facilities are at your disposal.

NATIONAL ALUMINATE CORPORATION

6222 West 66th Place • Chicago, Illinois

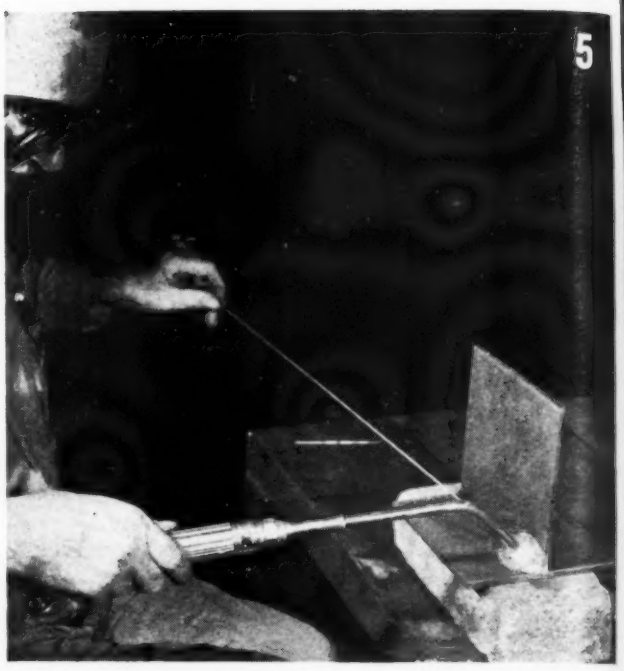
Canadian inquiries should be addressed to Aluminate Chemicals, Ltd., 555 Eastern Avenue, Toronto, Ontario

Nalco

The Complete Water Treating Service

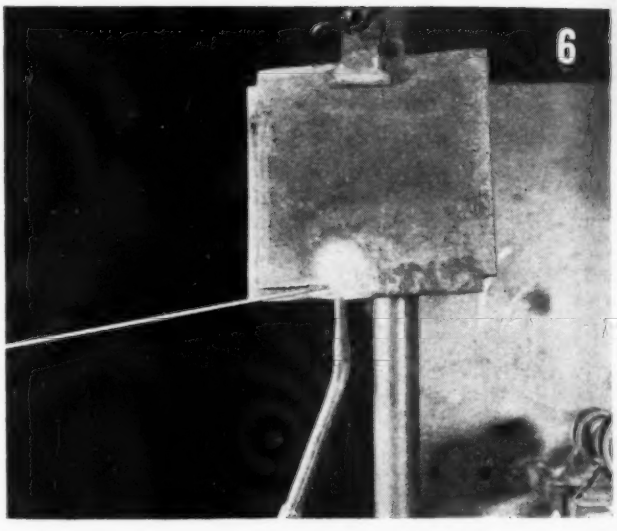
HOW TO LEARN TO MAKE FILLET WELDS

Continued from page 120



5 Tack weld two additional pieces of the ¼-in. plate, arranged so they are perpendicular to each other as shown in the photo. Heat the plates for about an inch at their intersection. Hold the blowpipe flame almost perpendicular to the lower plate and play most of the heat on this plate because it takes longer for it to reach the welding temperature than the vertical piece. Be sure to get the lower plate thoroughly hot back under the edge of the joint.

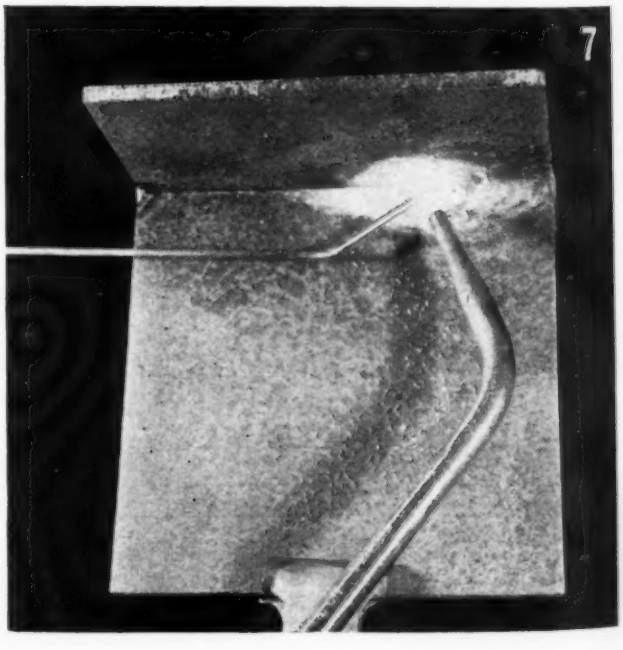
When both pieces are ready to weld, change blowpipe angle to about 45 deg, with flame pointing toward unwelded part of seam. At the same time introduce the rod, likewise at a 45-deg angle but pointing backward or toward the weld's starting end, and making a 90-deg angle with the blowpipe tip. Proceed to make the weld just as if it were between two edges, beveled to make a 45-deg angle on each side. Continue weld to completion in one-inch sections. Specimens for test should be welded on one side only; for practice, fillet welds can be made on both sides of vertical plate



6 Clamp in the blowpipe bracket of the rolling rig the two pieces of ¼-in. plate used for making fillet welds in the flat and vertical positions. Place plates vertical, with an unwelded edge at the bottom as shown in the photo. This makes an ideal setup for making a practice overhead fillet weld.

Heat bottom of vee thoroughly, playing most of heat on lower plate. Bridge over bottom of vee for about ¼ in. being sure to get thorough fusion. Hold blowpipe so flame points upward. Force of flame holds puddle in place and molten metal does not tend to drip off as might be expected.

When bottom of vee has been closed, introduce welding rod, holding it almost parallel with line of weld. Hold end of rod in puddle and melt it off. Do not lift rod out of puddle and do not stir molten metal. If it appears that puddle is about to get out of control, flick the flame away momentarily and metal will solidify. Keep puddle as small as possible but do not fail to secure thorough fusion. Do not add metal from rod until previously deposited weld metal again becomes molten; otherwise laps, cold shuts, or misses will occur in weld



7 Tack weld the remaining two pieces of ¼-in. plate, arranging them at right angles to each other and mount them in the clamp as shown in the photo. Execute an overhead fillet weld in the inside corner, as described in (6). Play most of the heat on the ceiling, or upper plate. Vertical plate soon becomes molten from radiated heat. Close about one-quarter of the vee root at a time and then fill in with welding rod, holding the rod and the blowpipe in the position shown in the illustration

EDWARD FORGED STEEL RELIEF VALVES *Stand Guard*

LIKE ALL valves in the Edward line, Edward relief valves are simple, functional and sturdy in design. There are only a few parts, all precision-built to withstand severe service. Body is forged steel, bonnet rolled steel. Renewable stainless steel seat and accurately ground stainless steel ball disk for tight seating. Rolled steel screw cap is vapor proof. Fine carbon steel spring of adequate length for full relief area when discharging.

Size—Fig. 141	Dimensions in Inches		Weight, Lb.
	Center to end	Center to top	
¼ & ⅜	1½	6½	2½
½	1⅞	7¾	4¾
¾	2⅛	9½	6¼
1	2 ⅜	10	13
1¼	2¾	12¼	19½
1½	3⅛	14¼	30½
2	3¾	16	40

INQUIRIES should include information concerning service, frequency of operation and relieving pressure desired. For additional details on relief valves and other cast and forged steel valves in the Edward line write for Edward BETTER VALVES Catalog No. 101.

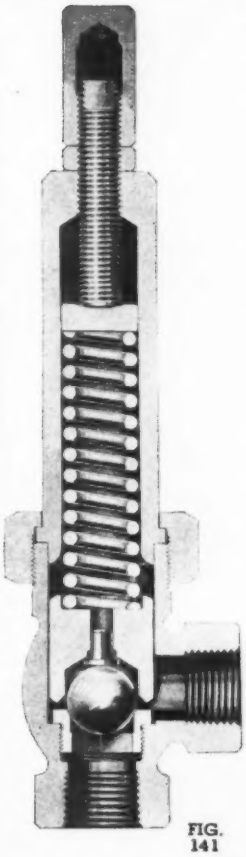


FIG. 141

TO PROTECT EQUIPMENT against abnormal increase in pressure, choose Edward steel relief valves.

Built in ¼ in. to 2 in. sizes, Edward relief valves are widely used in power, marine, chemical process, petroleum, refining, hydraulic and general industrial service.

Edward relief valves withstand heat as well as pressure. Design of adjusting mechanism and length and generous proportions of spring makes close pressure relief regulation possible.

THE EDWARD VALVE & MFG. CO., INC.
1220 West 144th Street
EAST CHICAGO, INDIANA

EDWARD *Steel* VALVES
CAST AND FORGED

ENGINEERS' BOOKSHELF

Diesel Plants

DIESEL AND GAS ENGINE POWER PLANTS (1943.) *By Glenn C Boyer, Burns & McDonnell Engrg Co. Published by McGraw-Hill Book Co, 330 West 42nd St, New York, N. Y. 447 pages, 6 x 9 in., 182 charts and diagrams, 71 tables, appendix containing 12 conversion tables, cloth cover. Price $4.00.*

A book devoted to design and construction of *diesel plants* has long been needed to supplement the many excellent texts which deal mainly with *engines* and only incidentally with the plant as a whole. From wide and long experience as designer of successful diesel installations, Mr Boyer has written a comprehensive and practical book that goes a long way toward filling this gap in the literature.

The book starts logically with a discussion of load analysis, engine and plant performance and the economic factors involved in a plant study. Succeeding chapters deal with the special problems of industrial power installations and pipeline pumping stations.

Following a valuable chapter on layout of plant buildings, the author takes up in turn the various components of the plant, in chapters on engine selection, fuel oil and gas fuel, lubrication, engine cooling, intake and exhaust systems, piping, waste-heat recovery and accessories. Much useful data is given on electrical equipment and on electrical-system layout, a feature of plant design deserving of careful attention. Chapters on plant maintenance and equipment testing complete the book.

Many nomographic charts and short-cut procedures have been included in the text as an aid to simplification of calculations. Derivations of formulas are given where they serve to clarify the material but involved mathematical treatment has been avoided in an effort to keep the work as practical as possible and of maximum usefulness to the designer and operator.

Marine Engineering

MARINE ENGINEERING—*By J M Labberton, Lieut Comdr, USNR. Published by McGraw-Hill Book Co, 330 West 42nd St, New York, N. Y. 439 pages 6 x 9 in., illustrated. Price $4.*

A brand new summary of just the kind of information about marine boilers, engines and auxiliaries that a stationary engineer needs to bring him up to date on ship practice. Practical approach to marine problems of combustion, boilers, turbines, pumps, heat exchangers, forced draft, marine electricity, refrigeration, ship feed systems, heat balance, diesels, and electric drive tempered with just enough introduction to hull design and propellers to give an engineer a working background of ship terminology.

Every item begins with an explanation of why a particular equipment has been adopted for marine practice. Wording has been so simplified as to be readily understandable by an engineer with practical shore experience. Arrangements of machinery in C-1 and C-3 ships are illustrated.

Recommended for any engineer who contemplates going back to sea or wants to become a licensed marine officer for the first time.—SAT.

Electricity

ELECTRICAL AND RADIO DICTIONARY—(Second Edition, 1943). *By Carl H. Dunlap, Chief Engineer, Electrical Division, American School, and Enno R Hahn, Editor and Consulting Engineer, Popular Mechanics Magazine. Published by American Technical Society, Drexel Ave at 58th St, Chicago, Ill. 110 pages, 5½ x 8 in., illustrated, tables, cloth binding. Price, $1.00.*

This little book contains 18 pages of electrical symbols with a picture of the object opposite; 73 pages of practical definitions of electrical and radio terms; and 16 pages of electrical formulas, tables and explanations of the

(*Continued on page* 168)

Changing your address soon?

You will help us give you the good service that is your due by notifying us at once of your change of address. Often the monthly issues of POWER go out of print almost immediately after publication, preventing us from supplying issues that may have been misdirected. Prompt notification of address changes that have been made or will be made prevent your missing a single one of the big valuable monthly issues of POWER.

Name.....

Old Address.....

.....

New Address.....

.....

New Co.....*Position*.....

Send to Circ Dept POWER, 330 W 42nd St , New York, N.Y.

. . . if so, please fill in and return this coupon

Extra protection for workers. This section of Steel Interlocked Hose sucks abrasive dust from grinding wheels . . . a "safety" application of American Flexible Metal Hose that affords protection for employees and thereby helps cut absenteeism and lost time.

Constantly soaked in grease. Five lengths of Flexible Interlocked Steel Tubing convey cartridge cups into pans as they are punched out by this blanking machine. Entire operation is bathed in lubricant and grease — but it can't rot or damage this all-metal construction in the least. Can be bent to any position to act as a "chute".

Flexible Oil Feed and Coolant Tubing is a special product of American Metal Hose for machine tool applications. Furnished in any length as required, this flexible metal tubing easily bends to any desired position, and *stays put* when bent.

Metal Hose on the War Job—

GRINDER DUST, CARTRIDGE CUPS, LUBRICATING OIL

Using virtually any workable metal, we can furnish flexible hose or tubing for anything from a simple spout to a high pressure hydraulic line (*American Seamless*) that can be flexed millions of times without breaking.

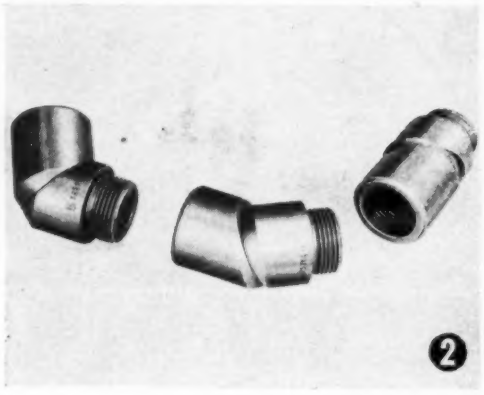
If you need a flexible connector for conveying air, water, oil, steam or fuel—for connecting misaligned or moving parts, or isolating vibration—chances are we have a type of hose or tubing that will do the job better. Complete descriptive literature available on request. 43199

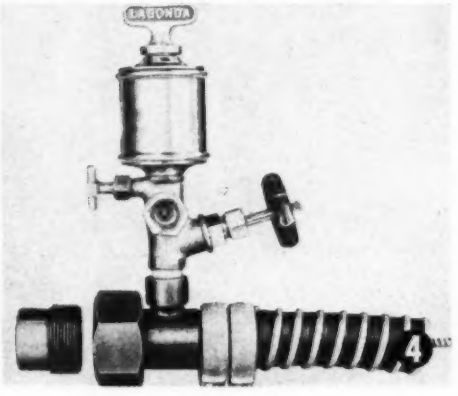
AMERICAN METAL HOSE BRANCH
OF THE AMERICAN BRASS COMPANY
General Offices: Waterbury, Connecticut
Subsidiary of Anaconda Copper Mining Company
In Canada: Anaconda American Brass Ltd., *New Toronto, Ontario*

ANACONDA

American Metal Hose

WHAT'S NEW IN PLANT EQUIPMENT





Tube Cleaner and Accessories

FOOT THROTTLE VALVE illustrated, Fig. 1, enables one man to carry out all functions incidental to tube cleaner operation. Valve operates through the application of pressure on a lever connected to a cam which controls the movement of the internal valve parts. Through action similar to that used in operating an automobile accelerator pedal air supply can be controlled between shut-off and full air pressure or throttled to any pressure between these two extremes. Since valve control is maintained by operator's foot, both hands are left free to guide and control movement of the tube cleaner. Valve is designed so that the operator's weight does not bear directly on valve parts and consequently the device is said to stand up under hard service.

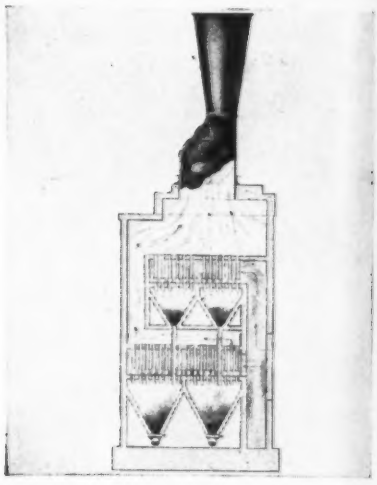
In connection with units to clean curved tubes the company has developed on accessory known as type FH flexible coupling. Fig. 2, to serve as the connecting piece between the main supply hose and the tube cleaner motor. In the past, with cleaners for curved tubes a short section of hose has been used as the connecting piece between the main supply hose and cleaner. New coupling provides sufficient flexibility to negotiate sharp bends and presents full cross-sectional area for the unrestricted flow of air from the supply hose to the motor with resulting high efficiency.

The 1300 series is addition to tube cleaner line, Fig. 3. Improvements or developments made available through a better knowledge of metallurgy and heat-treating methods have been incorporated in this latest design. An improved lubrication system insuring the flow of air carrying the necessary lubricating oil to both front and rear bearings has been provided. The new machines have been proportioned so that they can be used in both straight and curved tubes, without sacrificing power.

Lubricator, Fig. 4, features use of ¼-in. flexible metallic hose placed on the inside of the operating hose, the object being to conduct oil directly into the tube cleaner motor without contact with the rubber hose. Said to save hose and accomplish better lubrication. Old type automatic lubricator (not illustrated) used considerable piping and two valves. New simplified design, illustrated, saves material and accomplishes the same purpose more simply, maker says. *Elliott Co, Jeannette, Pa.*

Ceramic Tubes

CERAMIC TUBES of special fire clay used in dust collectors to conserve steel. Tubes mounted in concrete or brick casing above concrete bins entirely eliminate use of steel. Because tubes are composed of non-priority materials, many companies formerly unable to



obtain preference ratings will be able to obtain prompt delivery of new apparatus. Dust collector's operating design is same as steel-tube Thermix dust collectors. Ceramic tubes are sufficiently thick and rugged to be proof against breakage from normal handling or changes in temperature and weigh no more than steel tubes. *Prat-Daniel Corp, Port Chester, N. Y.*

Percentage Timer

PERCENTAGE TIMER automatically controls percentage of time at which any ac circuit can periodically be closed or open out of a definite length of a time cycle. Said to be particularly applicable where one function bears a definite time relation in percentage or operation of a second function, such as to regulate any input to electrically-operated furnaces, ovens or heaters; controlling pro-

(*Continued on page* 176)

LESSONS FOR TRAINEES
WARTIME PIPING INGENUITY!
SAVING A JOB WITH BUSHINGS
WHEN YOU'RE SHORT AN ELBOW
HOW TO MAKE A SCREWED REDUCING FLANGE

TIPS ON VALVE TRIM
How to Repair Valves
11 SIMPLE WAYS TO GET BETTER SERVICE FROM PIPING EQUIPMENT
Short-Cuts to Faster Piping Jobs
FOR SPECIFIERS
FOR PIPEFITTERS
HOW TO KEEP YOUR PLANT GOING WITHOUT INTERRUPTION!
HELPFUL HINTS ON CHOOSING VALVES FOR BETTER PIPING SERVICE

Ask for as many sets as you can use. First come, first served.

"Piping Pointers" Give the Answers

On the ingenuity of piping men depends the flow of our fighting supplies. How to get pipe lines installed and keep them working right despite material shortages is what today's piping trainees must learn quickly.

For your trainees, there's valuable help in Bulletin 6 of the "Piping Pointers" series—a Crane service aiding hundreds of plants in better wartime maintenance. Examples of the hints it gives—short cuts to faster piping jobs—practical suggestions on substitutions for critical materials—are shown above.

FREE ON REQUEST—**As the leading maker of valves and fittings, Crane Co. gladly shares the basic information on which "Piping Pointers" are founded, to help all industry get better service from piping equipment. Copies of Bulletin 6 and others supplied free by asking your Crane Representative, or by writing to: Crane Co., General Offices, 836 South Michigan Avenue, Chicago, Illinois.**

ARMY E NAVY

CRANE VALVES

No Shoes, No Feet . . .

Just after the Armistice in the last war, an American destroyer commander on Mediterranean patrol decided his men ought to celebrate with a real Thanksgiving dinner. After scouting over much of war-torn Europe, he located 400 lb of turkey at a dollar a pound, and the cooks got orders to produce the "fixings." The job was so complicated, and the commander got so worried over it, that at dinnertime on the fateful day, he couldn't eat.

As he stood on the bridge wing, the men began to come out on deck, looking as stuffed as the turkeys had a little earlier. To a big fireman, the commander called down, "How was the dinner, Paddy?" The big bruiser picked his teeth with his tongue for a minute or so before he said, "Well, sir, there was too damn' much white meat!"

Griping is a tradition in the armed services. As a matter of fact, every American considers it his God-given right to grouse at every opportunity. He growls when he is happy and growls when he is upset, and only another American can tell which sentiment he is expressing. As some soldier said on the radio recently, "An American will fight for his right to disagree."

That's all well and good, if it isn't carried to the extreme at which the grouser begins *to believe it himself*. Then it becomes pure complaining, and is as damaging to the morale of himself and others as anything can be. There are plenty of current chances to do damage, too, what with gasoline and fuel and food rationing, job restrictions, rising costs, and the other unavoidable consequences of global war.

We've got to face these and other current problems as realities. It's all right to gripe, if that helps ease the situation, but we mustn't get to squalling about it like a broody hen does over a doorknob. We can't help matters anymore than she can by getting worked up.

An old Arabian proverb on the desk of Major-General Levin H Campbell, jr, comes closest to setting a standard of conduct. Here it is:

"I had no shoes and complained—
until I met a man who had no feet."

George Edwards
Engineer

INTERLOCKED is One Rod Packing that

Can't Come Apart

TODAY virtually the entire production of J-M Packings and Gaskets is urgently needed for weapons of war, the factories that produce those weapons and the ships and planes that carry them to the fighting fronts. As a result, delivery on other than high-priority orders may be slower than in normal times. However, through increased capacity and a 24-hour-a-day, 7-day-a-week manufacturing schedule, every step is being taken to assure the fastest delivery possible under the present emergency.

J-M INTERLOCKED—*the greatest single improvement ever made in braided packing*

Once Interlocked is installed, you can be sure that repacking jobs will be few and far between. This unique braided material has no jackets to wear through or come apart . . . no plaits to loosen. It is braided square, rather than pressed into shape, and thus presents a better contacting area . . . provides a tight seal with minimum gland pressure and take-up.

J-M Interlocked is provided in a variety of styles to meet a wide range of operating conditions. For details, and for facts on other money-saving J-M Packings and Gaskets, write for Catalog PK-12A. Johns-Manville, 22 East 40th Street, New York, N. Y.

JM PRODUCTS

Johns-Manville PACKINGS & GASKETS

POWER LINES

Personal notes, items of general interest, the latest from Washington:—all the news that is news in the power field

Joseph W Hays Dies; Combustion Pioneer

Joseph W Hays, the first man to be known as a "combustion engineer" and founder of what is now The Hays Corporation, died in Grinnel, Iowa, April 22, 1943 at the age of 75.

Probably no man in America was so well known to boiler room operators as Joe Hays. A practical operating engineer, consultant, writer, lecturer, inventor, teacher, he touched intimately the lives of thousands working to obtain better combustion conditions in the steam plants of the nation. His book, "How to Build Up Furnace Efficiency" now in its 18th edition with a distribution of over 125,000 copies, is the boiler room crews' operating bible and will perpetuate the name and knowledge of Joseph W Hays for generations to come.

Born in Chester township, Paweshiek County, Iowa November 12, 1868, Joe

(*Continued on page* 196)

Naval Diesel Engines Theme of OGP Meeting

The second wartime National Conference of the Oil and Gas Power Division, ASME, will focus attention on the use of diesel engines in naval service, in a program featured by an address by Rear Admiral Earl Mills, Asst Chief, Bureau of Ships, an inspection trip to the world-famous U. S. Naval Experiment Station, and a technical session devoted to maintenance of naval diesel engines. The meeting will be held June 14–16, with headquarters at the Lord Baltimore Hotel, Baltimore, Md.

Other timely technical papers sched-

(*Continued on page* 192)

Winchester Arms Blackout: Here's How It Happened

At two o'clock on the morning of May 5, power failure caused an unscheduled blackout at the Winchester Repeating Arms Company plant in Connecticut. According to the papers, the blackout left several thousand workers stranded at their workbenches and tied up production for 8½ hours.

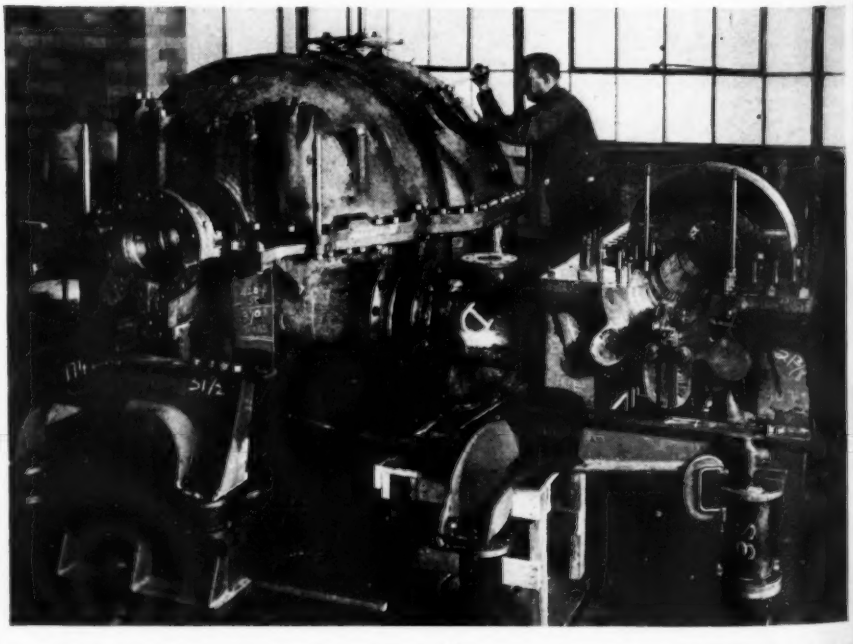
Thinking that readers would be interested in the engineering details of the accident, Power's editor contacted the company for information. Norman I S Boak, works manager, made the following statement, for publication in Power:

". . . the difficulty in our power plant occurred on the 150-psi header line which connects the 150-psi extraction points on our three high pressure extraction turbines.

"This line was put in with cast-iron flanges on steel pipe. One flange cracked and the pipe threads started, the pipe itself pulling out of the flange. The escape of 150-psi live steam drove the watch engineer and the switchboard operator out of the power end of the plant and kept them out for a sufficient length of time to drop the voltage sufficiently to knock out the station auxiliaries on the 650-psi boilers. When this was done, there was nothing to do but shut off the non-return valves on the 650-psi boilers, which were the only ones in operation; then the generating equipment shut itself down.

"The only way possible to get the high-pressure boilers going again was to fire up one of the old 150-psi boilers; since the break in the 150-psi line was between the 150-psi boiler and generator, it was not possible to get steam to the 150-psi turbine. It was not possible to get this steam to the turbine until the broken flange was replaced."

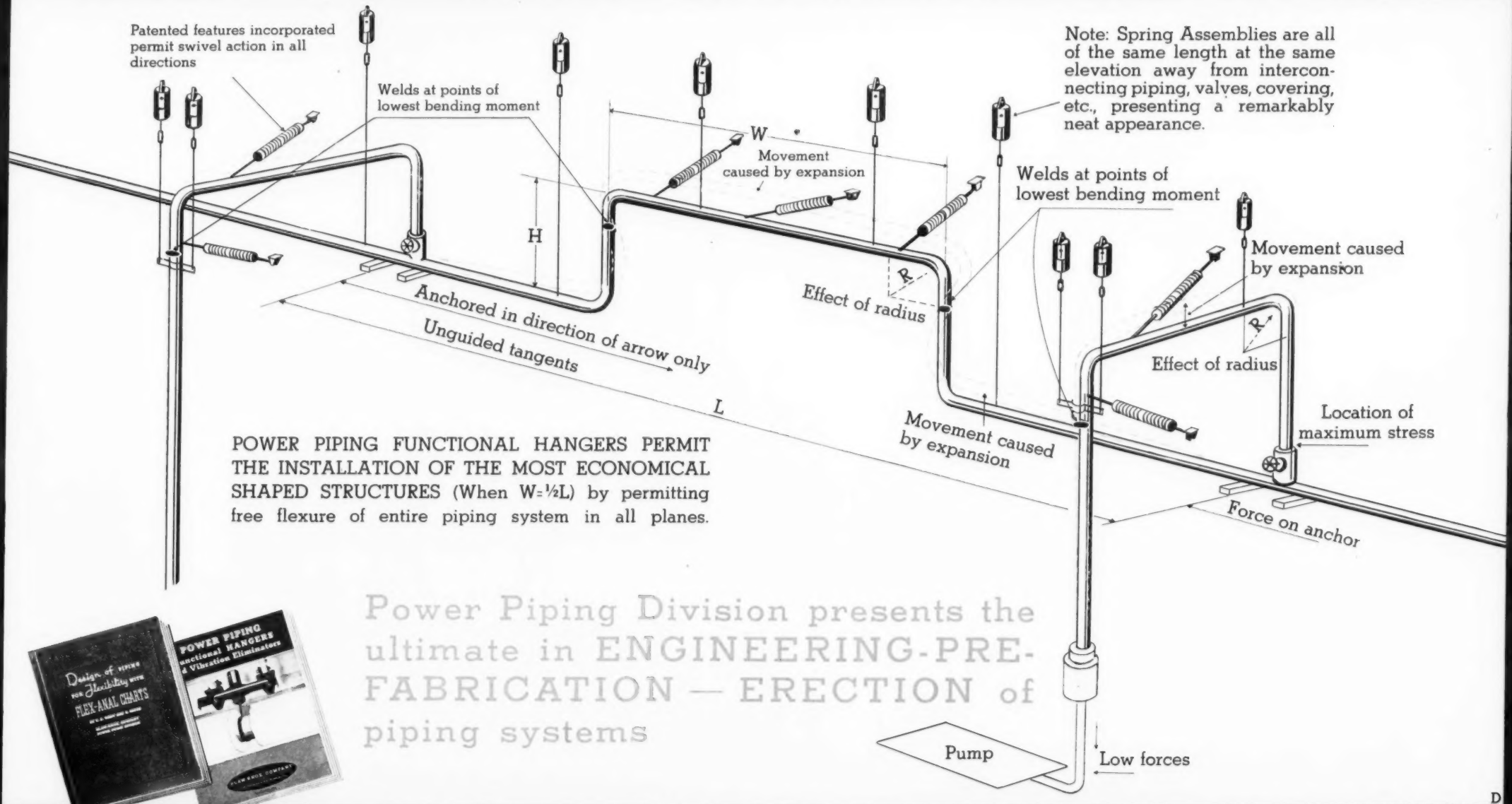
CARGO SHIP POWER



Designed to put 4000 hp into the propeller of a new war cargo ship, this Westinghouse marine steam turbine set weighs over 90 tons, including its speed-reduction gears. High- and low-pressure units are being test-assembled before spindles are installed. Low-pressure unit, left, and the smaller high-pressure cylinder at the right, each contribute 2000 hp to their pinion gears. Units are fabricated by assembly line methods in a new shop devoted solely to marine turbines and gears

THE SCIENTIFIC APPROACH TO YOUR

THE SCIENTIFIC APPROACH TO YOUR PIPING PROBLEMS


Patented features incorporated permit swivel action in all directions
Welds at points of lowest bending moment
W
Movement caused by expansion
H
Anchored in direction of arrow only
Unguided tangents
L
Effect of radius
Note: Spring Assemblies are all of the same length at the same elevation away from interconnecting piping, valves, covering, etc., presenting a remarkably neat appearance.
Welds at points of lowest bending moment
Movement caused by expansion
Effect of radius
Location of maximum stress
Movement caused by expansion
Force on anchor
Pump
Low forces

POWER PIPING FUNCTIONAL HANGERS PERMIT THE INSTALLATION OF THE MOST ECONOMICAL SHAPED STRUCTURES (When W=½L) by permitting free flexure of entire piping system in all planes.

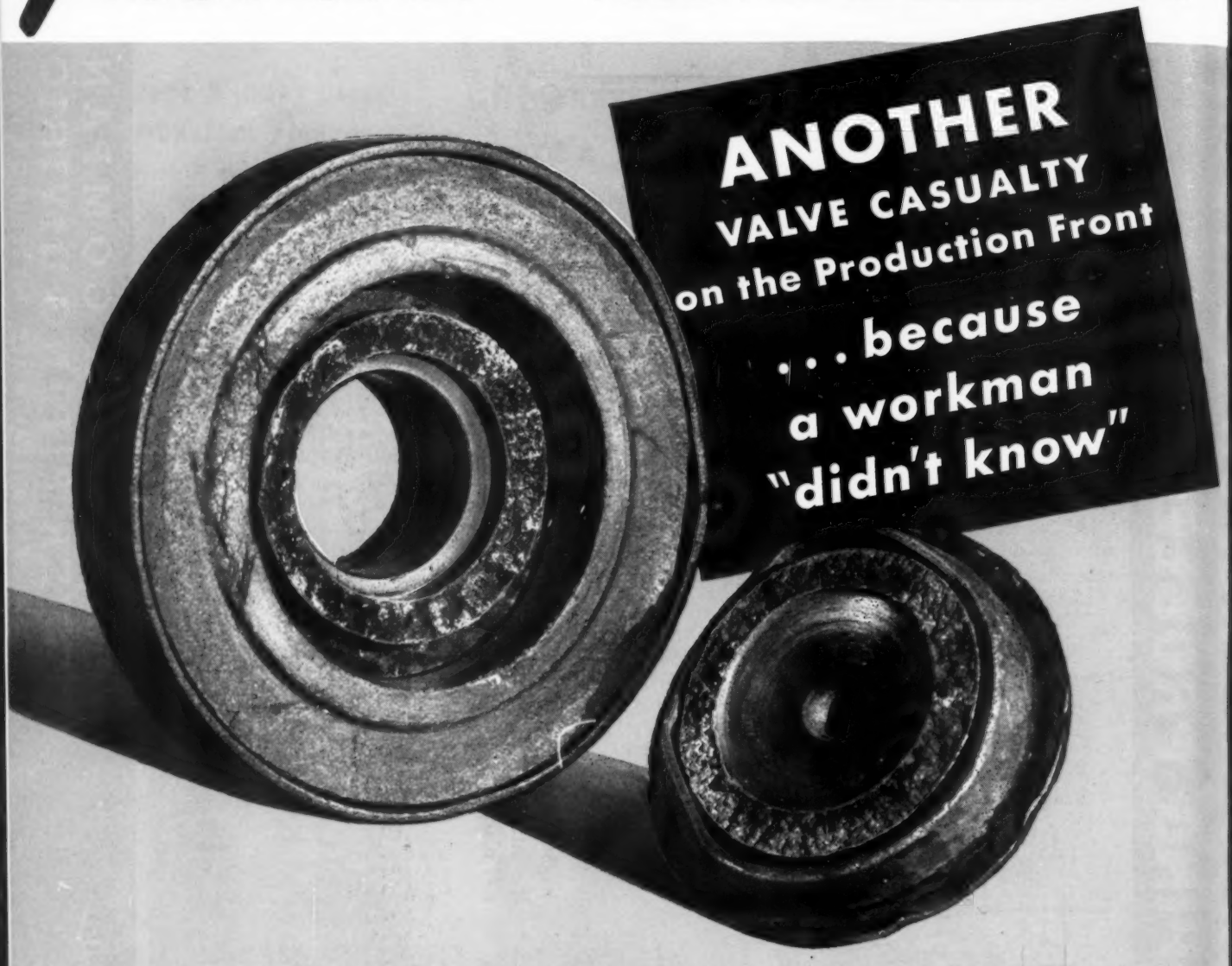
Power Piping Division presents the ultimate in ENGINEERING-PREFABRICATION — ERECTION of piping systems

The correlated use of FLEX-ANAL CHARTS and HANGER BULLETIN 1863 saves time in engineering man power which can be devoted to other useful purposes. Copies of these books can be obtained through a request on your business letterhead.

D

BLAW-KNOX COMPANY
POWER PIPING DIVISION
1525 PENNSYLVANIA AVE., PITTSBURGH, PA.

Prevent Valve Failure



Because some workman didn't understand valves, this bronze disc holder from an Iron Angle Valve has been completely destroyed. The valve failed to close tightly when he turned the wheel by hand, so he applied extra leverage with a wrench or length of pipe through the spokes, building up a thrust of thousands of pounds, which eventually forced the spindle through the disc holder. As the heavy section at the break indicates, the disc holder is made amply strong for any normal pressure and could be destroyed only through extreme carelessness or abuse.

Such destruction of valve parts represents much more than a simple loss in dollars and cents. It represents the waste of a critical metal and scarce valve parts – replacements being available only with a high priority. Most important, it represents a loss of valuable work-hours while repairs are made – plant shutdowns that may stall the flow of vital materiel to our fighting forces.

The prevention of such needless destruction is the imperative responsibility of every plant management today. Maintenance workers should be thoroughly trained, and provided with necessary tools, before vital valve installations are placed in their care.

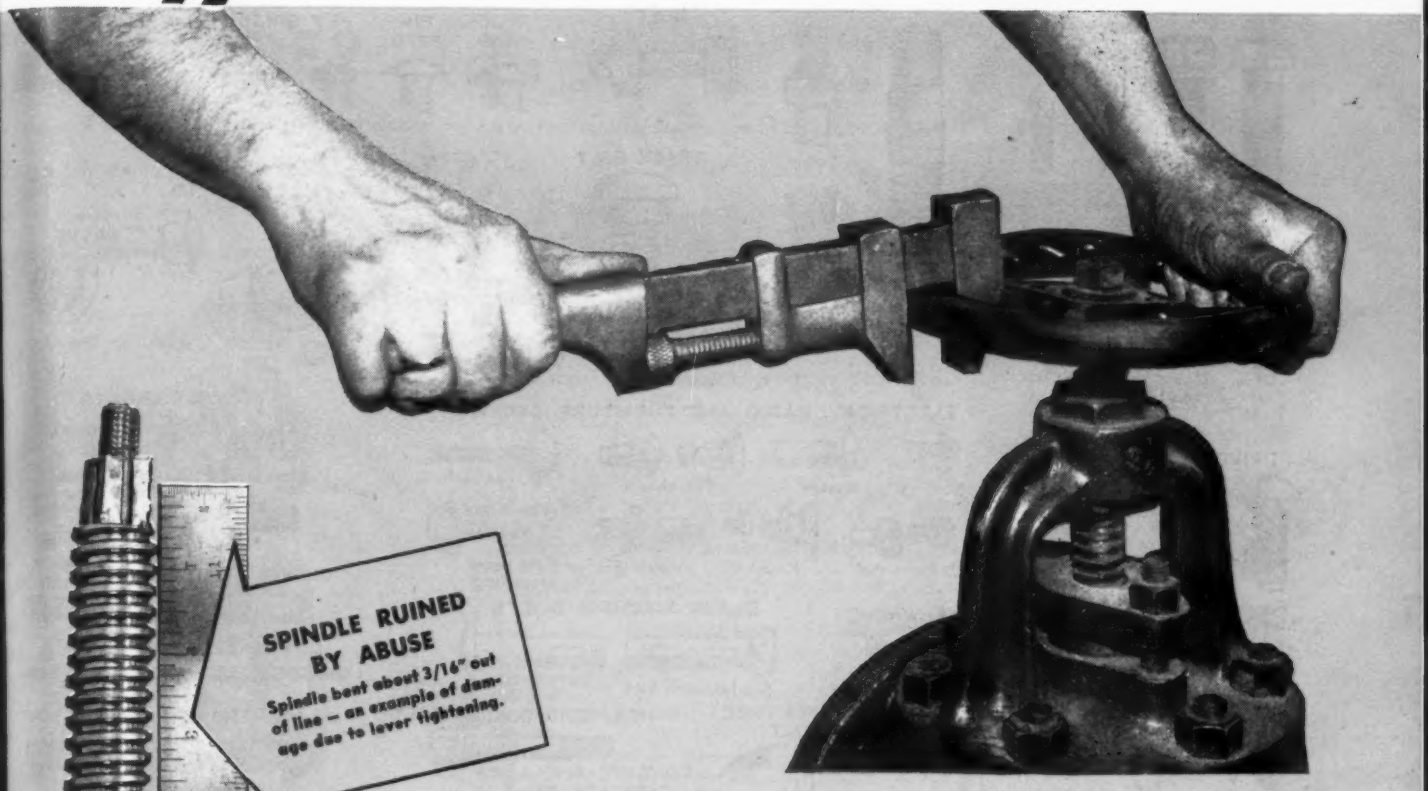
Valves should be inspected frequently, systematically. Worn parts should be repaired or replaced before a valve destroys itself. Valves for new services should be carefully selected, properly installed. With these simple precautions, most valve failures can be prevented before they start.

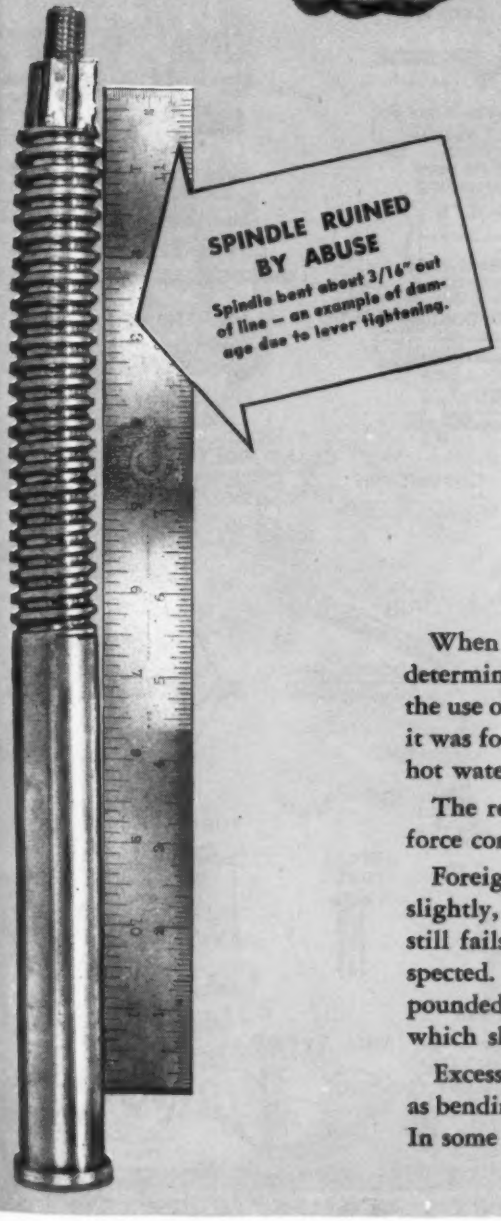
Consult Jenkins engineers for any advice you need in improving your system of valve conservation.

Jenkins Bros., 80 White Street, New York, N. Y.; Bridgeport; Atlanta; Boston; Philadelphia; Chicago. Jenkins Bros., Ltd., Montreal; London.

JENKINS VALVES

before it starts!





HOW NOT to correct a leaking valve seat

When reasonable hand effort won't close a valve tight, the cause should be determined at once. The trouble is usually due to foreign matter on the seat, or the use of the wrong type of disc for the service. In the ruined valve illustrated, it was found that a steam-service disc had been used which was too hard for the hot water service in which the valve was installed.

The remedy is to correct such conditions, *never* the use of extra leverage to force complete closure, which can destroy iron, as well as bronze valves.

Foreign matter on the seat can usually be flushed off by opening the valve slightly, to create a jet of high velocity through the small opening. If the valve still fails to close tightly after this procedure, the seat and disc should be inspected. If the disc in use is unsuitable, it should be replaced with a disc compounded for the service. Another possible cause might be a damaged seat, which should be refaced.

Excessive leverage tightening may also damage the valve in other ways, such as bending the spindle, or stretching the threads on the spindle or in the bonnet. In some cases it may even strip the threads, or break the handwheel.

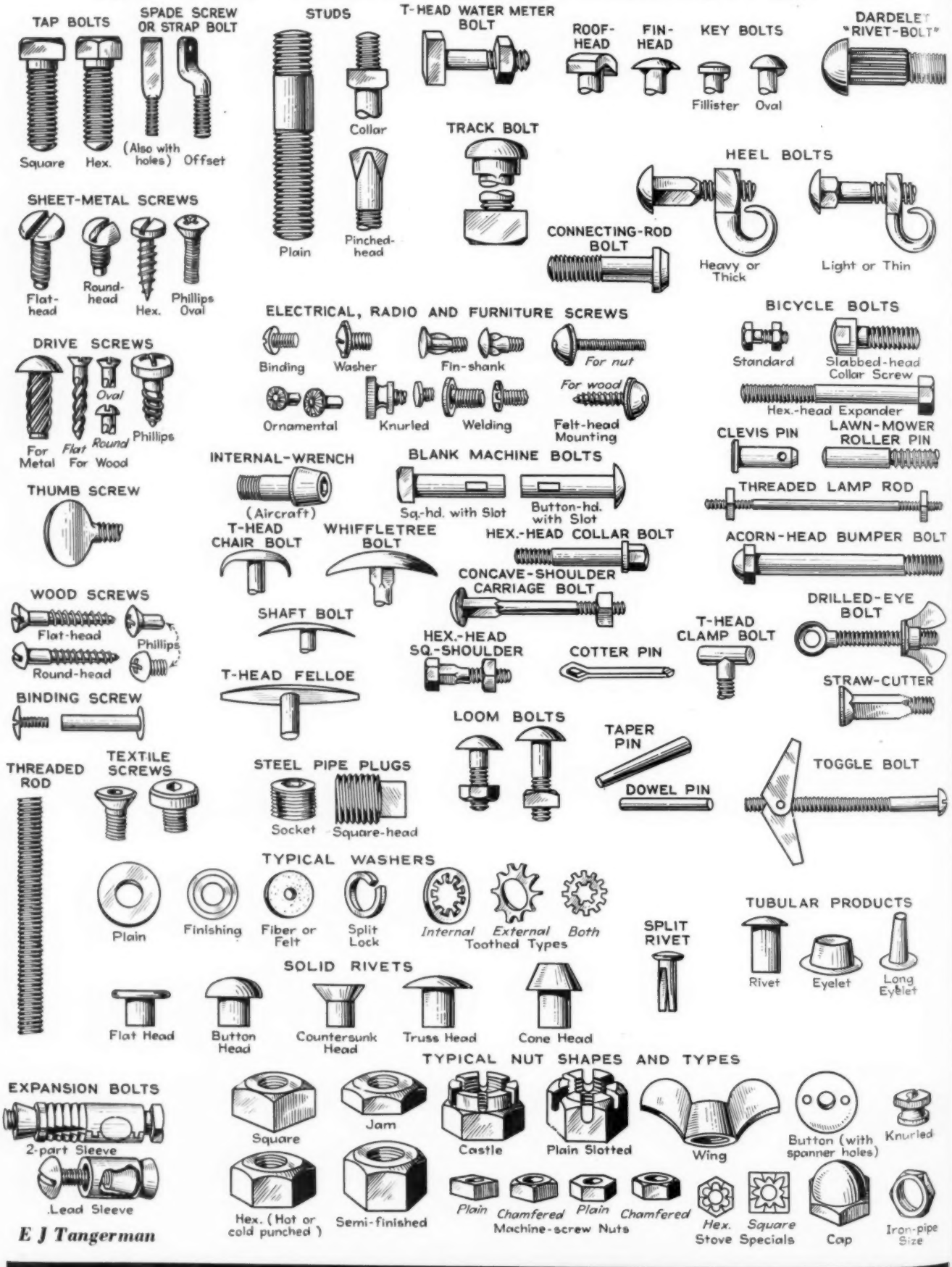
For every industrial, engineering, marine and power plant service

BRONZE ★ IRON ★ STEEL

POWER'S DATA SHEETS

Number 130

Typical Bolts, Screws, Nuts and Other Fastening Devices—2



E J Tangerman

© POWER

DID YOU EVER SEE 5 BOILERS EXPLODE?

"Neither had we as we stood out of breath on the nearby hill, knowing that we had done everything possible to stop the fire. The frame structure that housed our five boilers was a mass of flames—there was only one thing left to do and that was 'scram.' We made the hill and we waited—there was one satisfaction to the boss—the boilers were insured. Still we waited and watched the flames play up and down the boiler stack. Out of the stack, as we could see through the flames, the smoke curled from the working boilers just as if nothing unusual were happening. Then all of a sudden there stood the five boilers—the frame exterior had crumpled to the ground—still the chimney smoked and we waited and waited."

This happened a good many years ago. The facts are in the insurance inspector's report. He credited the COPES Feed Water Regulators with saving these boilers. They continued to operate through smoke and fire after the crew had fled—they kept the water level safely above the tubes.

Dramatic, you say? We say this kind of protection is everyday performance for COPES on more than 65,000 boilers.

These are the facts given to our service man and to the insurance inspector.

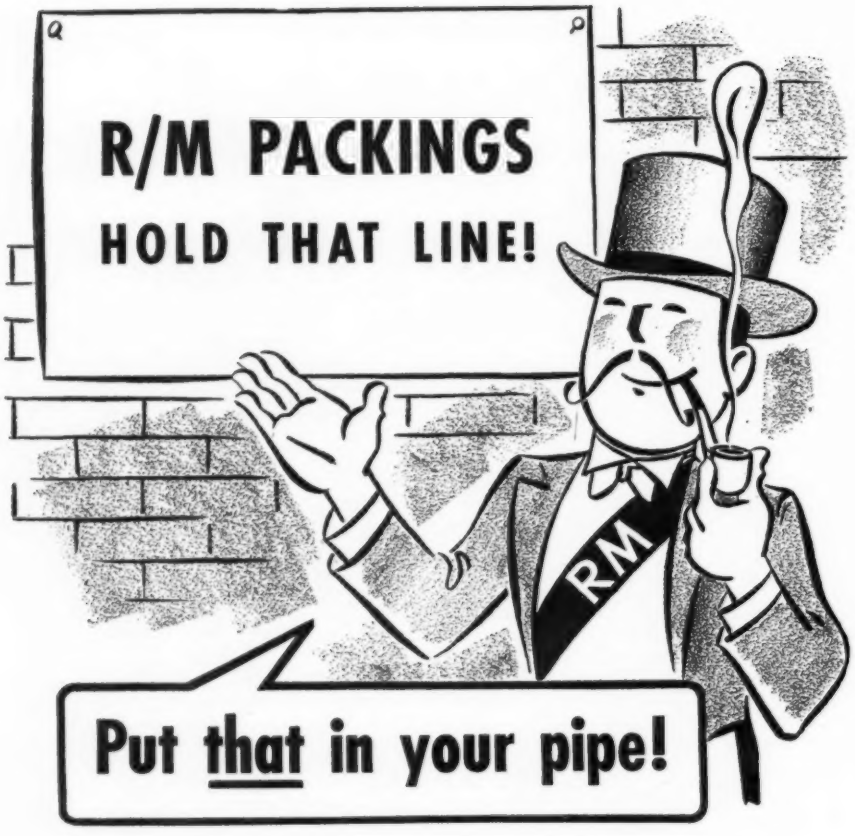
You will want to know more about the regulators that protect over 65,000 boilers. Write for general catalog.

NORTHERN EQUIPMENT COMPANY
631 Grove Drive, Erie, Pennsylvania
FEED WATER REGULATORS • PUMP GOVERNORS • DIFFERENTIAL VALVES
LIQUID LEVEL CONTROLS • REDUCING VALVES AND DESUPERHEATERS
Branch Plants in Canada, England • Representatives Everywhere

OVER 60,000 COPES FEED WATER REGULATORS IN SERVICE

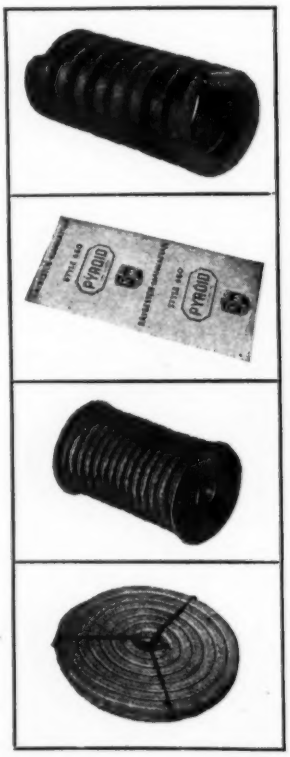
COPES — FEEDS BOILER ACCORDING TO STEAM FLOW-AUTOMATICALLY

★ GET CLOSER LEVEL CONTROL WITH THE FLOWMATIC ★ REGULATOR



Under the forced draught of war production, pipe-lines have to stand up under increased pressures. It is the patriotic duty of R/M packings to see that the steam, air, fuel, or oil gets where it's going, without blowouts and leaks through faulty seals. And these packings do their duty!

Lights burn brightly in R/M laboratories as engineers work early and late to improve these products for the stepped-up jobs to be done. Practical experience in the field adds to their knowledge, too, and the net of it all is better packings for every purpose.



Awarded to R/M
North Charleston Plant

Do you have a copy of the R/M catalog? It's keyed for applications, illustrated, and indexed as to materials and types. Ask your jobber.

INDUSTRIAL SALES DIVISION
RAYBESTOS-MANHATTAN, INC.
MANHEIM, PA.
BRIDGEPORT, CONN. NORTH CHARLESTON, S. C. PASSAIC, N. J.
Makers of Packings for Every Industrial Use

Toledo's Stations

(*Continued from page* 66)

starting, motor field coils are short circuited through field-discharge resistors, and the field coils are not excited until about 18 sec after the motor-starting switch is closed.

Interlocks on the valves insure correct valve positions during starting and protect the system against starting or running two motors on the same pump at the same time. An alarm system warns of overheated motor bearings, tripped circuit breakers, loss of pump prime, and other operating troubles that arise.

At this station a 134-v storage battery provides for emergency lighting and operation of oil circuit breakers. This energy source is maintained by a combination of Rectox trickle and high-rate bulb automatic charger. Two banks of power transformers, each consisting of three 250-kva, single-phase, 60-cycle units, with 6900-v primary and 240- and 480-v secondary windings, supply all low-voltage power and lighting requirements of the station, as well as all power and lighting for the chemical building, the filter plant and the machine shop. They are connected so that one bank is in service at all times. Should voltage fail on the active bank, the load would be automatically transferred to the other.

Careful planning and engineering preceded the building of these stations and care has gone into their construction. Now that they are in full operation, Toledo may well be proud of this important contribution to the national war effort.

Refrigeration Facts

(*Continued from page* 71)

pliers or stilson wrench on them; use a wrench that fits even if you have to make it.

The main liquid valve on receiver, commonly called the *King* valve, should be kept closed during the charging operation. Watch compressor for charging of too much liquid, evidenced by sharp knocking in compressor and by discharge pipe getting cold. Control this by partly closing the ammonia-drum valve. Watch level of ammonia in receiver, making sure gage-class cocks are open.

Some of the smaller plants have combination condensers and receivers with no gage glasses. Estimate the amount of

Once there were two Soldiers...

THE FIRST was a veteran elevator maintenance man. His fighting job was keeping elevator cables and fittings in condition for the duration. Installing them correctly, lubricating them regularly, checking and adjusting them consistently. Thereby conserving steel for direct war production, releasing wire rope for front-line duty . . . This first soldier *knew* he was contributing directly to quicker Victory — and he was proud of his job.

The second "soldier" was not so sure. He was an elevator operator, out of retirement to release younger, abler men and women for war. He knew his job was a necessary one—but he wondered if he couldn't contribute more to Victory. Yet this second soldier was contributing just as directly as the first. Yes, by conserving steel, saving wire rope.

For by operating his car *correctly*—starting and stopping smoothly, accelerating evenly, levelling off properly at floors—he was insuring the best working conditions for the wire rope in his care. Relieving it of unnecessary shocks and jolts, minimizing localized wear, granting it *maximum* service life. In the fullest sense, his was a soldier's job too.

☆ ☆ ☆

Yes, your elevator operators are conservation soldiers, just as much as your maintenance men are! You can help them realize their importance in the war conservation job—and thereby get longer service from your present equipment. Be sure *all* of your operators understand how to operate their cars correctly. Check their performance just as regularly as you check maintenance schedules. You'll find the results in longer life for your elevator cables.

DO YOU HAVE YOUR SUPPLY OF ROEBLING ROPE CONSERVATION TAGS?

To help you make your ropes last longer, serve better, Roebling engineers have condensed a whole check list of installation and maintenance helps on a 4 x 5-inch tag for handy reference. Ask for your free supply of Tag "C".

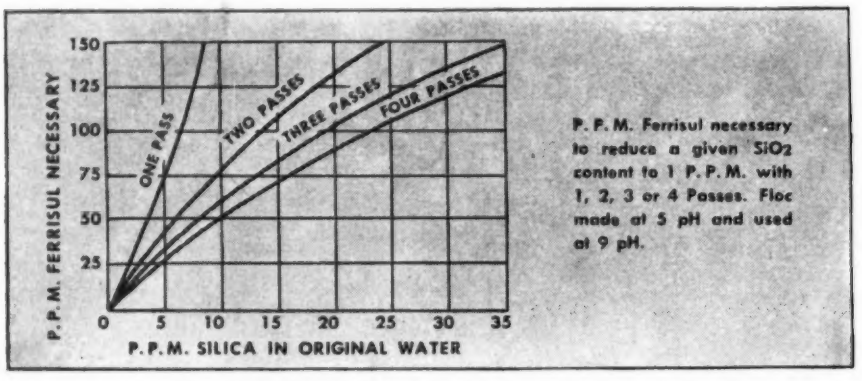
JOHN A. ROEBLING'S SONS COMPANY
TRENTON, NEW JERSEY
Branches and Warehouses in Principal Cities

★ PROMPT SERVICE
★ on essential orders
★ from warehouse
★ stocks or mill

ROEBLING
"Traction Steel"
ELEVATOR ROPE

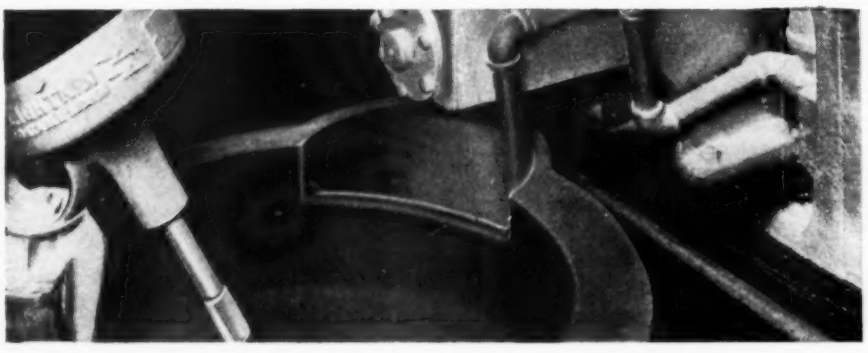
TWO WAYS TO SAVE *FERRISUL* . . . AND STILL GUARD AGAINST *SILICA*

To the hundreds of power engineers who have added vital extra pounds to steam output and equally vital hours to the lives of boiler tubes and turbine blades by treating feed water with Ferrisul . . . here are two useful hints on how to make the most economical use of the limited supplies of Ferrisul now available . . . and still rid your boiler feed water of silica and other enemies of heat transfer efficiency *without* leaving equally dangerous scale-forming or corrosive residuals.



P. P. M. Ferrisul necessary to reduce a given SiO_2 content to 1 P. P. M. with 1, 2, 3 or 4 Passes. Floc made at 5 pH and used at 9 pH.

1. It may pay to look into the application of multi-stage or counter-current use of the ferric hydrate floc formed by Ferrisul. The savings possible are obvious from these curves showing parts per million of Ferrisul needed to reduce a given silica content to one P. P. M., with 1, 2, 3 or 4 passes of the feed water through the Ferrisul floc.



2. Check your feeding equipment to make sure Ferrisul is dissolving completely. If you use dry feed equipment, when shutting down (1) stop the dry feeder and water feeder simultaneously and (2) continue agitation for at least thirty minutes to be sure no undissolved Ferrisul is left in the pot. In restarting, start agitator, then start feeding Ferrisul and water simultaneously.

Ferrisul today is being widely used in pickling war-vital metals where it is preferred over similar chemicals for many of the same reasons that have made it a favorite in your field: (1) its higher iron content and resultant economy (2) its greater uniformity and (3) its greater ease of storage and handling.

As a result, the demand for Ferrisul is heavy these days and it is essential that the most efficient possible use be made of every pound. If you wish, Monsanto's competent and experienced technical staff will be glad to offer specific suggestions on possible economies in your plant. For their help, inquire: MONSANTO CHEMICAL COMPANY, Merrimac Division, Everett Station, Boston, Mass.

MONSANTO CHEMICALS
SERVING INDUSTRY . . . WHICH SERVES MANKIND

Help! **Prompt return of empty tank cars, carboys and returnable drums will help speed your *next* shipment of Monsanto chemicals . . . by helping to relieve critical shortages in shipping equipment.**

liquid in these closely by feeling bottom and sides; that portion containing liquid is cold.

When drum is almost empty, bottom and head as well as charging line will frost. Keep compressor operating until frost begins to melt off charging line; close valve on drum and then close the liquid-line charging valve. Next, carefully loosen union connection. Ammonia will probably issue from the loose union; if objectionable, spray the joint with water until ammonia is dissipated. Then disconnect and check drum's tare weight.

Be sure to replace stopper plugs in drum valve outlet and in liquid line charging valve outlet. Never leave an open-ended connection, such as purge valves and charging valves, on an ammonia system. A solid steel plug is best; ordinary cast-iron plugs are unreliable and difficult to remove.

Fix Leaks First

As it is necessary to keep ammonia in the system, fix leaks at the first opportunity. They can be detected by the sense of smell, by litmus paper, which when wet turns red in the presence of ammonia and by sulphur tapers, which give off a dense smoke when burned in the presence of ammonia. Most leaks occur around stuffing boxes of valves and shafts. The remedy is obvious: Keep them tightened and when packing becomes old and hard, renew it. Use special ammonia packing made for this purpose. Clean valve stems with emery cloth and coat with an oil film to prevent rusting. When painting, keep paint off valve stems.

When leaks occur at flanges, such as cylinder heads and crankcase covers, don't tighten bolts when machine is in operation. Stop it and pull up evenly on all bolts. When leaks occur in pipe threads, take down the joint, clean thoroughly and examine threads on pipe and in fitting. To hold ammonia, threads must be full and clean-cut; renew broken or damaged ones. Apply a paste of litharge and glycerine to the pipe thread—not inside the fitting. Be sure the litharge is fresh because its deteriorates if it stands too long.

Many plants have lost an entire charge of ammonia through unsuspected leaks in the system's safety valves that were piped out doors. Make it a weekly practice to test the relief line on the roof, or wherever it terminates, for evidence of ammonia fumes. Sometimes these valves start leaking for no apparent reason except old age, but usually abnormally high pressure is the cause. Test high-pressure cutouts at least once a month and make sure

NO. 6 OF A SERIES

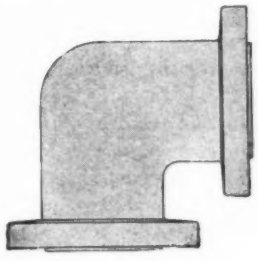
HOW TUBE-TURN WELDING FITTINGS BENEFIT WAR INDUSTRY

The FIRST WELDING FITTINGS 1ST AND STILL THE BEST

Weight saved with Tube-Turn Welding Fittings aids war industry—by economizing steel, speeding pipe erection, conserving supports, reducing shipping weight.

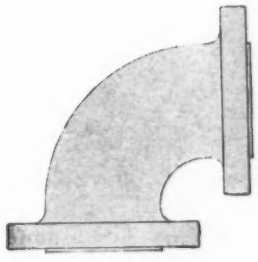
**Tube-Turn fittings in comparison below are 6", Schedule 80. Other fittings are 6", 600 lb. class.*

FORGED FLANGED ELBOW



450 lbs.

CAST STEEL FLANGED ELBOW

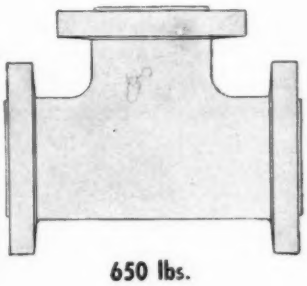


250 lbs.

TUBE-TURN WELDING ELBOW

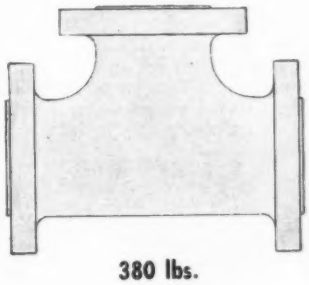
33½ lbs.

FORGED FLANGED TEE



650 lbs.

CAST STEEL FLANGED TEE



380 lbs.

TUBE-TURN WELDING TEE

80 lbs.

THE examples illustrated above demonstrate the tremendous differences in weight between Tube-Turn welding fittings and other types of steel fittings. These comparisons are for 6" size (see note above), and other sizes are more or less proportionate.

Weight saving *always* has been an important reason for specifying Tube-Turn welding fittings. But today's war production needs stress additional advantages of this feature. It saves steel—because less of this strategic metal is required in making Tube-Turn fittings. Piping systems welded with Tube-Turn fittings are *lighter* and *streamlined*—which speeds erection, saves space, and simplifies structural problems. Remember these timely points when you buy or specify fittings for oil, gas, power, chemical, heating, air, refrigeration and marine piping today!

OTHER WAYS TUBE-TURN FITTINGS HELP WAR PRODUCTION:

SPEED INSTALLATION: Less time needed for aligning thanks to true circularity and uniform walls. Only simple butt welds required, easy even for novice welders. Whole section can be pre-assembled on the ground.

SAVES SPACE: Tube-Turn fittings permit streamlined, compact layouts and sharp angles—neater, more efficient piping.

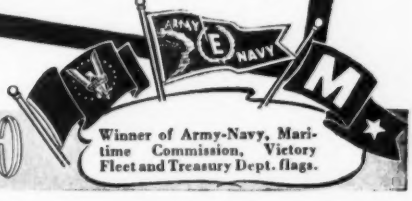
REDUCES MAINTENANCE: No gaskets to replace, no nuts or bolts to tighten. Maintenance practically eliminated. Relieves men for other duties.

AVOID SHUT-DOWNS: Practically no danger of shut-downs due to connection failures as welding with Tube-Turn fittings *eliminates* the chances of leakage.

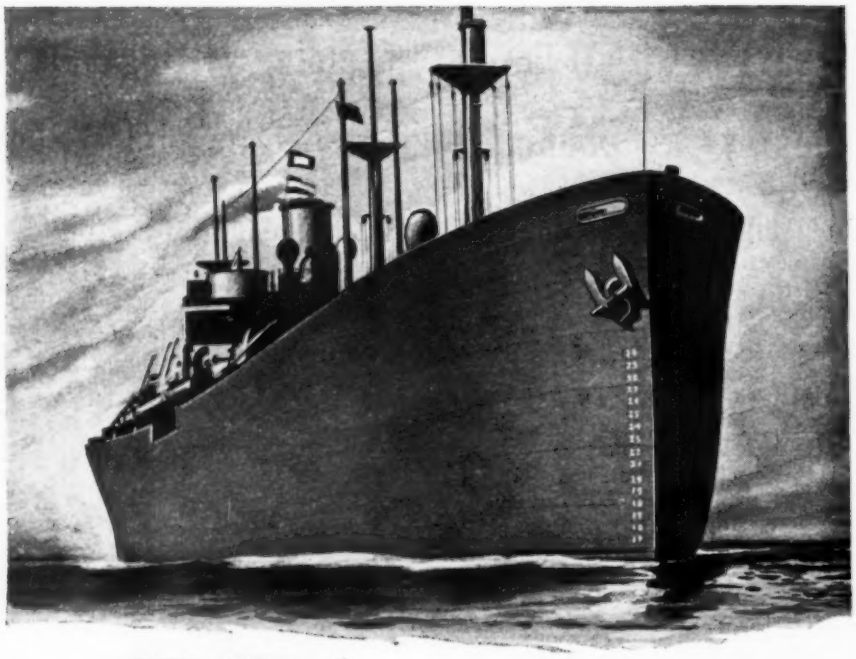
INCREASE SAFETY: Exclusive manufacturing process gives greatest possible strength in fittings, full freedom from leakage, and longer life in piping systems.

TUBE-TURN
TRADE MARK
Welding Fittings and Flanges

TUBE TURNS (Inc.) Louisville, Ky. ● *Branch offices:* New York, Chicago, Philadelphia, Pittsburgh, Cleveland, Dayton, Washington, D. C., Houston, Los Angeles. ● *Distributors in principal cities.*



Winner of Army-Navy, Maritime Commission, Victory Fleet and Treasury Dept. flags.



How W-T's* Speed Shipbuilding

OF all the amazing production records established by American Industry in meeting the needs of war, none are more amazing than those established by American Shipbuilders. And no where is there a greater need for strong, leakproof, trouble-free piping installations than in the vessels built to carry supplies to American Fighting Men and their Allies.

Many leading shipbuilders have adopted W-T's* as the standard fitting for making right-angle, branch pipe outlets. They've quickly recognized the man-hour savings these fittings make possible by eliminating templets, cutting and fitting the main pipe. They've been quick to recognize that the reinforcing features incorporated in the design of W-T's* make possible leak-proof joints of full pipe strength . . . reduce vibrational stress . . . eliminate the necessity of extra braces . . . save material . . . reduce the weight of the system. They know the funnel-shaped intake aperture of W-T's* improves flow conditions . . . reduces turbulence and friction . . . increases operating efficiency.

Installation savings and operating efficiencies are not the only economies effected by W-T's*. Initial cost is no more . . . in many cases less . . . than other fittings without their advantages.

Shipbuilders are not the only ones who recognize the advantages gained by using W-T's*. They have found ready acceptance in oil refineries, power plants, for refrigeration and air-conditioning systems, in pulp and paper mills, chemical plants . . . in fact, wherever piping is used . . operating under a wide variety of conditions and a broad range of pressures and temperatures on all standard pipe sizes.

It's impossible to tell here, all the details of their many advantages. We suggest you write for a copy of Bulletin WT-31. You'll be well repaid for your trouble.

*WeldOlets-ThredOlets

3 Types Meet Every Need

Beveled outlet of WELDOLETS permits branch pipe to be attached with plain, circumferential, butt weld.

Threaded outlet of THREDOLETS permits branch pipe to be screwed into outlet of fitting.

Outlet of SOCKET-END WELDOLET is bored to accept standard outside pipe diameters. Junction is completed with weld around top of fitting.

All 3 types can be installed on the main pipe equally well with electric-arc or oxy-acetylene welding.

Forged Fittings Division

BONNEY FORGE & TOOL WORKS, Allentown, Pa.

WELDOLETS*
TRADE MARKS - REG. U. S. PAT. OFF.
THREDOLETS
Welded Outlets for Every Piping System

they are in good shape. In one case, the mercoid high-pressure cutout, which was corroded, stuck when the water supply was cut off without notifying the plant, the safety valve opened up and most of the ammonia was lost. If at any time you believe that the pressure has approached the relief setting, check for leakage. Some relief valves reseat themselves after relieving pressure; others contain a cartridge which has to be renewed.

Don't hesitate to use your ammonia mask. Keep it where you can reach it in emergency—away from the refrigerating equipment. After using the mask, don't depend on the used cartridge but order a new one immediately. Water is your best ally in fighting a bad leak, such as a broken pipe line or fitting might cause. Use plenty of water and direct the stream at the leak. If you must enter a confined space, such as a baudelot room or cold room filled with ammonia fumes, don't go alone; have someone stand by, to rescue you if necessary.

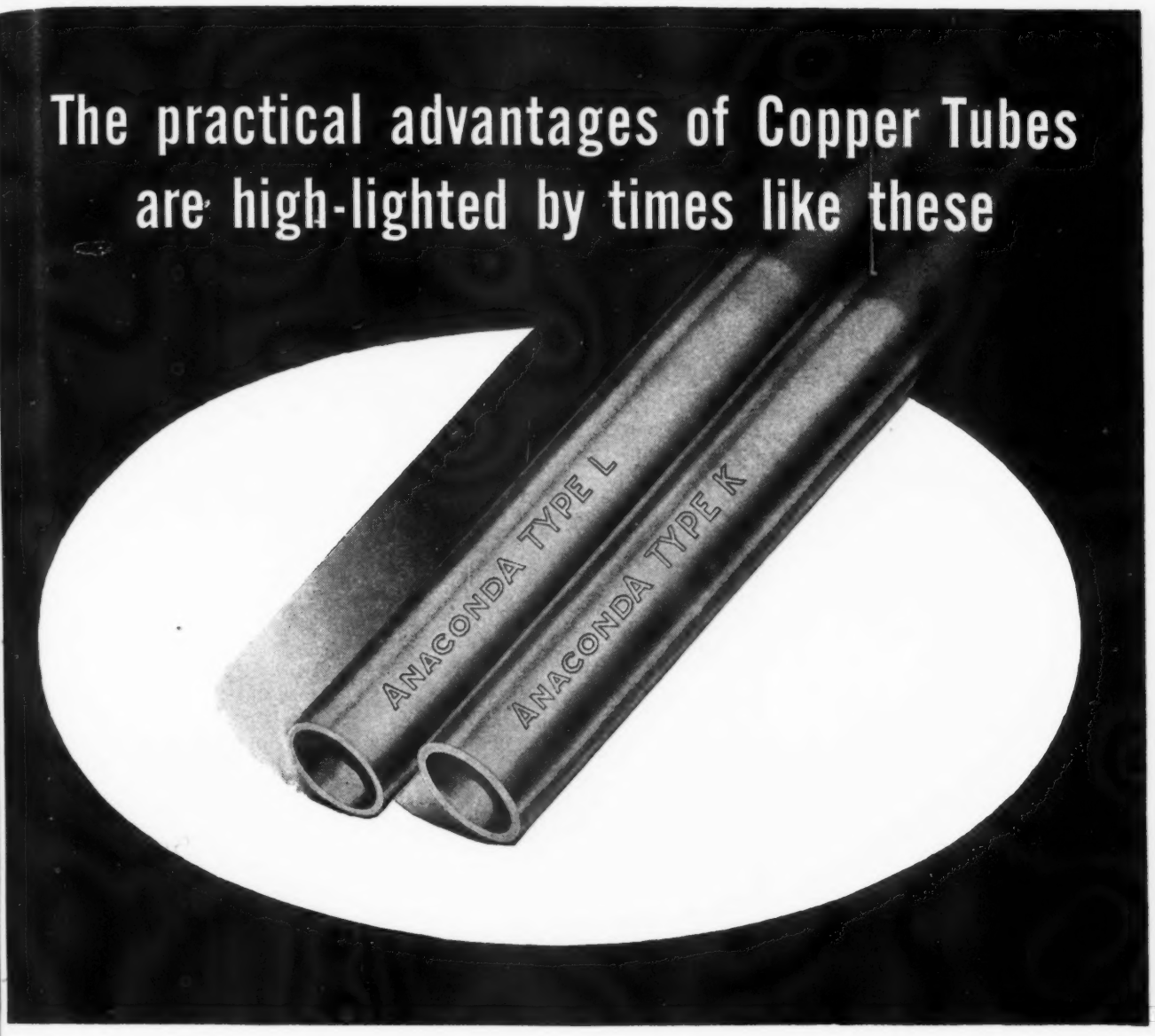
Dehydrate System

Freon-12 is a refrigerant that has come into general use of late years. It boils at —22 F and at 55 F a cu ft weighs about 89 lb or 12 lb per gal. Its action in a refrigerating system is quite similar to ammonia. Although Freon's non-toxic and non-irritating qualities make it an ideal refrigerant for confined spaces, absence of identifying odors makes leaks difficult to detect. Use extreme care in eliminating moisture from the Freon system since it has great affinity for water. When putting an ammonia system into service, blowing it out with compressed air usually suffices, but with Freon some dehydrating agent must also be used because the slightest trace of moisture ruins the charge.

Compressors are different in make and style—some are slow speed, others high speed. The extreme range of temperatures and the refrigerant's action make it imperative to use only a specially prepared oil. Some of the older slow-speed compressors depend entirely on splash lubrication. Later units have oil pumps and force-feed lubrication; the higher speed machines have additional force-feed lubrication with a sight glass and hand regulator to lubricate the cylinders.

On all machines, a sight glass on the crankcase shows the oil level. Watch this level at all times and keep it where it should be. At too high a level, the oil tends to pump over into condenser, receiver and cooling coils and to interfere seriously with their operation.

The practical advantages of Copper Tubes are high-lighted by times like these



With so much present emphasis on the preservation of existing equipment, as well as the most effective utilization of all productive capacity, the advantages of copper piping stand out conspicuously.

In plant after plant, where far-sighted management made copper tube installations before the war, these tubes are proving their worth in all-out production schedules—by providing easy maintenance and eliminating costly shut-downs due to rust-caused repairs. Anaconda Copper Tubes, with solder-type fittings, are economical, rustproof, dependable. Consider these practical advantages:

They stubbornly resist corrosion. They reduce pumping costs because their smooth interiors offer least resistance to flow. They save space . . . are easy to bend . . . easy to adapt when plant layouts are changed.

The use of copper is, of course, rigidly restricted by wartime needs, but we nevertheless suggest that you obtain for present and future reference a copy of our Publication C-24, "Anaconda Copper Tubes for Industrial Applications." 4350

THE AMERICAN BRASS COMPANY
General Offices: Waterbury, Conn.
Subsidiary of Anaconda Copper Mining Co.

In Canada: Anaconda American Brass Ltd., *New Toronto, Ont.*

ANACONDA *Anaconda Copper Tubes*

SERVICE FOR FOUR
at once

Saving time on power piping fabrication is common practice with Associated. For example, mobile, pre-heating, stress-relieving units are employed on high temperature, high pressure work. These portable units are available for both field and shop operations. Each is capable of handling four joints at once. Associated welders, certified under approved procedures, are highly efficient in the use of modern automatic temperature control equipment.

Give Associated your power fabrication problems. Let our organization, experience, skill, modern equipment serve you.

WAR PRODUCTION . . . This company is engaged in high priority war production, proud of its responsibilities and fulfilling them to the letter.

ASSOCIATED PIPING & ENGINEERING COMPANY
2332 EAST 38TH STREET
LOS ANGELES, CALIFORNIA

On compressors fitted with force-feed oiling to the cylinders, don't feed too much oil—four or five drops a minute is ample.

All modern compressors have a valve manifold cast in one piece with the valves plainly marked *Discharge, Suction, Bypass* and *Pump Out*. The older machines have the same arrangement except that the valves are separately connected with pipe and fittings. The purpose of these valves, as well as the bypass valve mentioned, is to provide a means of transferring and pumping out refrigerant from both the high or discharge side of the system and the low or suction side for the purpose of repairs, and to pump out air when repairs are completed. Check foundation bolts on machines regularly to see that they are tight.

Check alignment of belts, especially V-belts: Running with belts too slack wastes power and burns belts; running with belts too tight overloads the motor and compressor bearings.

Three types of condensers are in general use: The double pipe, the shell and tube and the evaporative. Efficiency, measured in gallons of water used per ton of refrigeration, ranks in the order named. To get the most out of them and save water and power, keep both water and refrigerant surfaces clean.

Oxide Rectifiers

(*Continued from page* 72)

In practice, the rectifying film is usually produced by a series of heat treatments and a rectifier, suitable for a given voltage, assembled with several disks in series. Usually, oxidized disks alternate with conducting disks, spacers and large disks that act as cooling fins, Fig. 3. The assembly is mounted on an insulating bushing and securely held together by nuts that give the pressure between disks necessary for good contact and low-voltage drop.

A common arrangement that uses four units to obtain full-wave rectification is shown in Fig. 4 and 5. When terminal *A* is positive, as in Fig. 4, current can flow through unit *C*, *dc load*, unit *D* to the minus line. When polarity reverses, as in Fig. 5, current flows from terminal *B* through unit *E*, *dc load*, unit *F* to the minus line. Comparison of arrows on Fig. 4 and 5 shows that even though line polarity reverses, current flow is always in the same direction through dc load.

These rectifiers are suitable for sup-

Faith in the Future

What's Behind the Trade Mark?

QUALITY TRADE MARK YOUNGSTOWN SERVICE

The Youngstown Sheet and Tube Company was founded in November, 1900 by 47 local investors, with an authorized capitalization of $600,000. In December, 1901, this capitalization had been increased to $4,000,000 to provide for the expanded program decided upon by the men of vision who planned the future of this company.

In February, 1902, 14 months after the initial meeting of the shareholders of this company, the first product carrying the Youngstown trademark was produced. In this same year, these pioneers took the first step to assure complete integration . . . the first producing blast furnace was purchased... the first ore properties were acquired... and the first coal lands obtained. These early acquisitions all served as a nucleus around which was created the great industrial organization, which in later years served mankind in every corner of the globe where products of civilization were making life more complete.

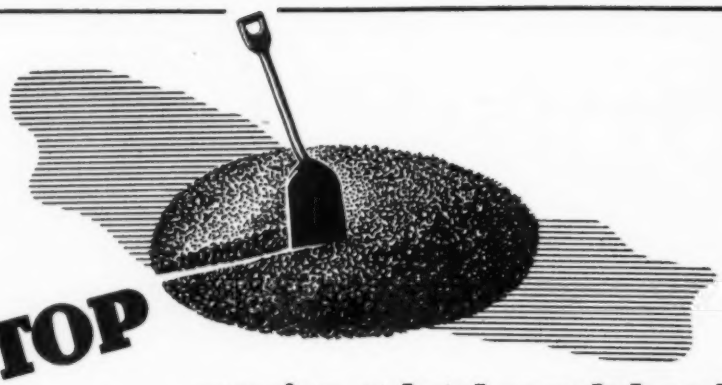
We are doubly appreciative of the efforts of those who preceded us at Youngstown. These men of faith, courage, foresight and action have bequeathed to us those things with which we can make a definite contribution in helping to win freedom for the world today, and upon which we can help build an assured prosperity for the future.

Pipe and Tubular Products - Sheets Plates - Conduit - Bars - Tin Plate Rods - Wire - Nails - Tie Plates and Spikes - Alloy and Yoloy Steels

The YOUNGSTOWN SHEET AND TUBE COMPANY, Youngstown, Ohio

Manufacturers of

CARBON · ALLOY AND YOLOY STEELS



STOP guessing at hand sampled coal

START automatic sampling . . . the

STURTEVANT WAY

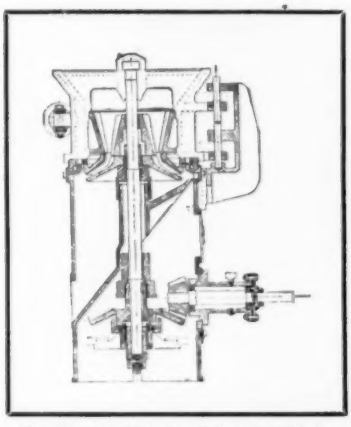
and get Facts to help BOOST PLANT PERFORMANCE and ECONOMY

Why gamble with your biggest item of operating expense — COAL? Why hold to hit-and-miss methods of appraising its value as a fuel for your plant? How much does a B.T.U. cost you?

All these questions demand correct answers today regardless of the capacity of your plant and the amount of your fuel bill.

By sampling your coal the "STURTEVANT WAY" you'll be doing what wise coal users are accomplishing—eliminating guess work, getting truly accurate information on representative samples, saving time and being in position to adjust your plant to the coal you're getting and thereby assure maximum performance with minimum chance of shut down.

Now's the time to know your B.T.U.'s and the "STURTEVANT WAY" is the proved way to do it. Results justify the means.



Simple in design and rugged in construction the **STURTEVANT AUTOMATIC COAL CRUSHER and SAMPLER** eliminates 32 out of 34 operations involved in hand sampling.

One ton of coal per hour is reduced from 3" samples to 8 mesh or finer in the **STURTEVANT.**

Reports from Users

"Since using your power sampler . . . this element of 'personal equation' has been entirely eliminated."

"Old hand methods required practically an entire day's time of one man, whereas it requires only a few minutes to run a 1000 pound sample through a crusher."

"Savings average $6000 per 100,000 tons."

SEND FOR a copy of Bulletin 85 "How to Sample Coal Automatically." FREE ON REQUEST.

Sturtevant Mill Co.

103 Clayton St., Dorchester, Boston, Mass.

plying dc from an ac source for small battery charging, electroplating, welding, operating switchgear, small dc motors and similar devices. A rectifier of this type can be used in series with the coil of a dc relay to make it operate on reverse current only, as in Fig. 6 and 7. As long as polarity of the circuit remains as in Fig. 6, current cannot flow through the relay coil. If circuit polarity reverses, as in Fig. 7, current can flow through rectifier and coil to cause the relay to trip a circuit breaker or perform any other operation.

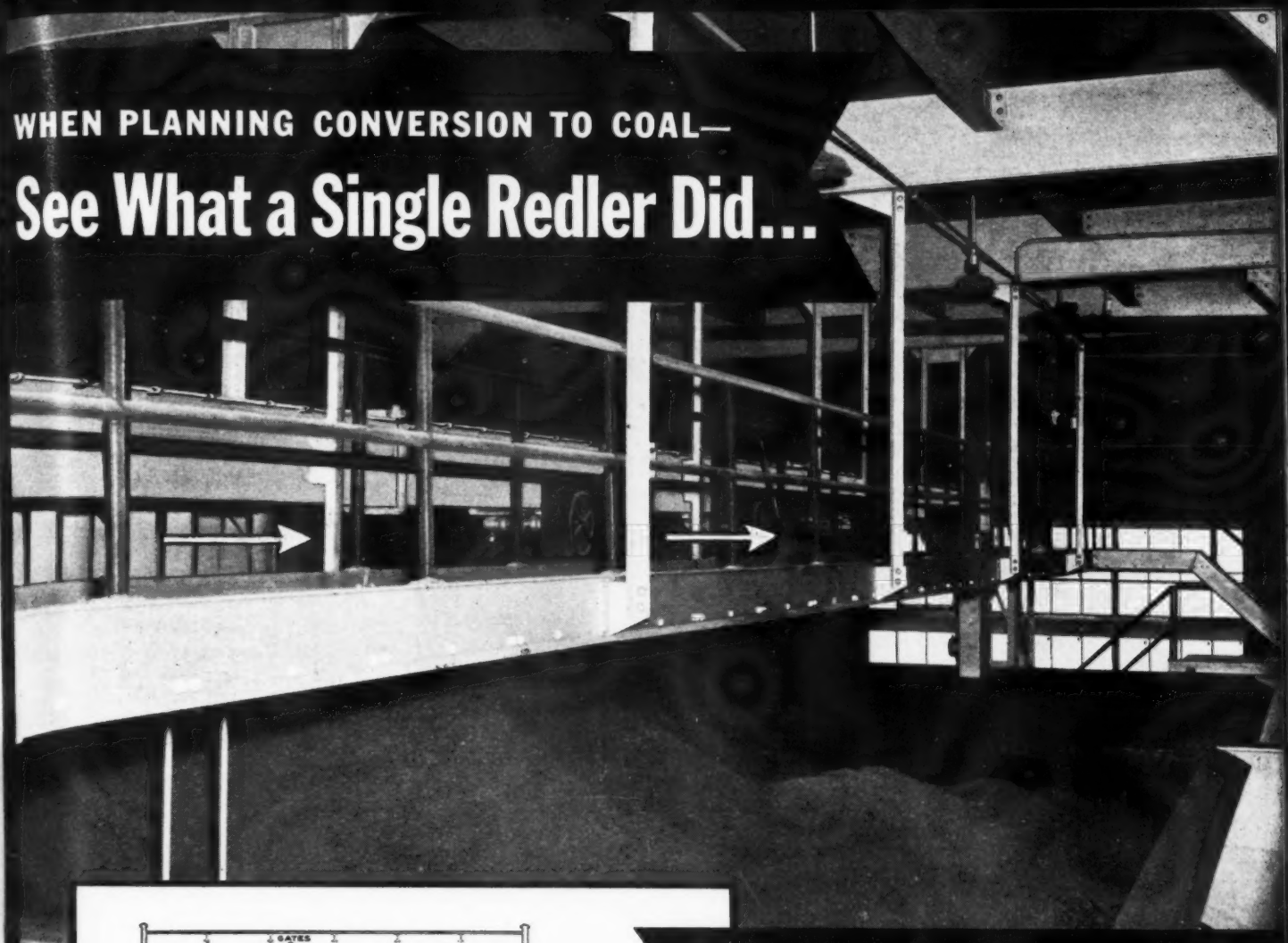
In a number of cases copper-oxide rectifiers have been used as discharge resistors across contactor and generator-field coils, as in Fig. 8 and 9. When the switch is closed, as in Fig. 8, current flows through the field coils, as indicated by arrows, but not through the rectifier. If the field circuit is opened, inductance of field coils tends to maintain the voltage for a short time and current flows through the rectifier, as indicated, to dissipate the energy stored in the magnetic circuit of the field coils without causing excessive voltage. A rectifier for this purpose has the disadvantage of high cost compared to a discharge resistor, but has the advantage of providing low discharge resistance that can be connected permanently across the field coils.

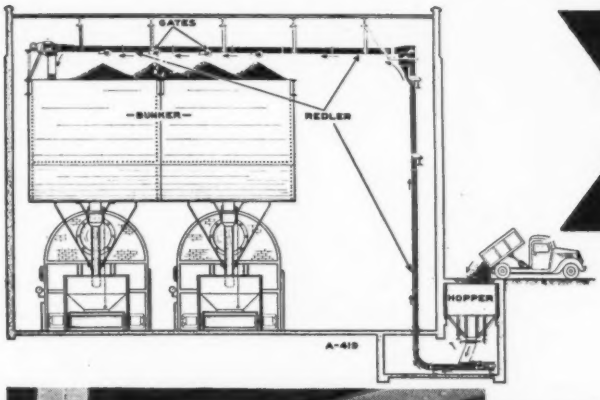
Still another application of copper-oxide rectifiers is to oppose the inductance of generator-field coils to cause quick decay of field current and drop in voltage. Fig. 10 shows a generator-field winding connected to a potentiometer-type rheostat. When contacts are in the position shown, full voltage is applied to the field coils and current flows as indicated by arrows. Moving the contacts to the extreme left, as in Fig. 11, short circuits the field coils for the generator voltage to become zero. When the field coils are short circuited their inductance tends for a short time to maintain a current through loop *L* from terminal *B* to *A*.

When a quick decrease in generator voltage is desired, as in variable-voltage-control systems, the effects of the induced voltage may be objectionable. This can be eliminated by connecting a copper-oxide rectifier in series between the two resistors, as shown. The rectifier permits easy passage of normal current flow through the field rheostat. However, if the self-induced voltage of the field coils tends to reverse the current through connection *L*, the rectifier acts as a check valve to prevent it. As a result, the magnetic field decay and, consequently, the voltage are more rapid than without the rectifier.

WHEN PLANNING CONVERSION TO COAL—

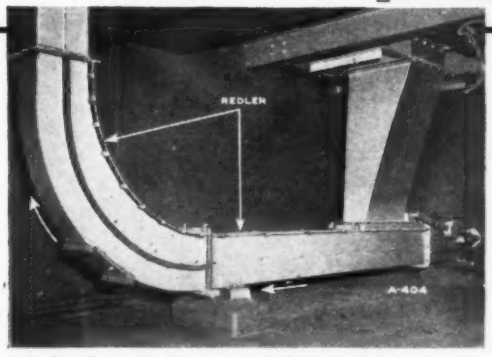
See What a Single Redler Did...





...with Anthracite

CONVEYED • ELEVATED • DISTRIBUTED



It is clear from the diagram and photographs how this self-feeding Z-shape Redler keeps bunkers for two large boilers filled automatically.

The reputation Redlers have built up in coal handling installations is not limited to bituminous. Here is a complete brewery power plant, using anthracite, where one Redler does the entire coal conveying job from truck to bunker.

These completely self-contained conveyor-elevators are compact and easily installed. In power plants under today's conditions they save manpower while firing steam power. Redler installations make possible conversion to solid fuel without loss of convenience, compactness and dust-free cleanliness.

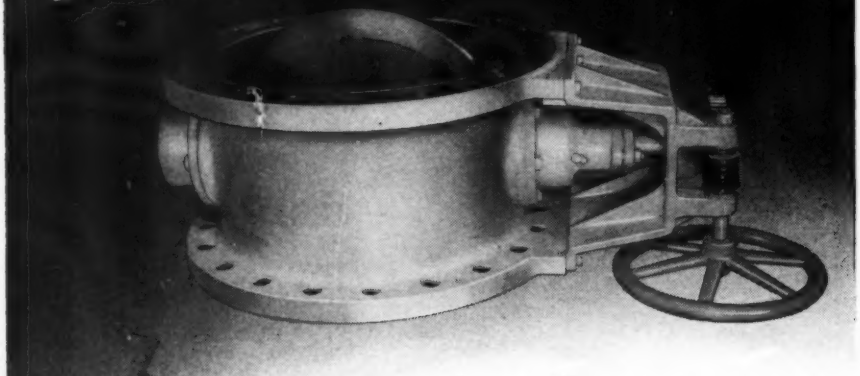
Post yourself on Redler performance when you plan conversion. Request Data Book No. 140.

STEPHEN S-A ADAMSON MFG. CO.

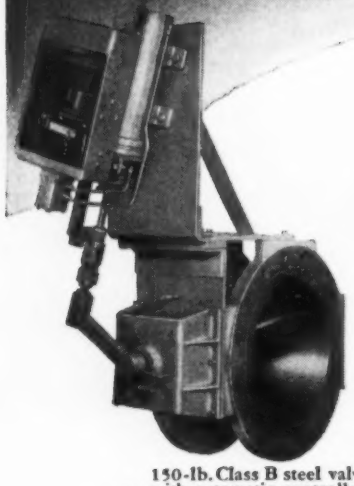
Chains and Sprockets · Belt Conveyors · Bucket Elevators · Crushers
Bin Gates · Pan Conveyors · SealMaster · Feeders · Screens
Speed Reducers · Redler Conveyors · Ball Bearings · Skip-Hoists · Winches and Car Pullers

5 Ridgeway Avenue, Aurora, Illinois

Service Duration Tripled with R-S BUTTERFLY VALVES



125-lb. Butterfly Valve with hand wheel control, American Standard flanges.



150-lb. Class B steel valve with automatic controller.

THE CASE HISTORY of a 6-inch, 125-lb. R-S Butterfly Valve illustrates the advantages and increased service to be obtained from this type valve. It was installed in a line leading to a condenser and used for shut-off under 70 lbs. pressure.

Previous installations of conventional type valves did not hold up and had to be replaced *every six to eight months* as the abrasive action of the fluid in the form of a high pressure "jet" wore a hole through the casing. When an R-S Butterfly Valve with "A" Metal was installed, the length of service was tripled.

R-S QUALITY PRODUCTS SINCE 1904

15 to 900 psi

Here is concrete evidence that even abrasive materials "fan out" into a crescent-shaped spray when the Butterfly Vane approaches a closed position. This fact, coupled with the use of "A" Metal in an R-S Butterfly Valve, produces outstanding results where hard wear and severe stresses are encountered.

The Butterfly Vane is not a "flopper." It is beveled and wedges against the valve body when closed. Compare—results prove the superior efficiency of this type valve under high or low pressures and temperatures.

Your R-S Distributor will gladly furnish detailed information.

VALVE DIVISION
R-S PRODUCTS CORPORATION
4836 Germantown Ave. Philadelphia, Penna.

R-S Streamlined BUTTERFLY VALVES

Colloidal Fuel

(*Continued from page* 75)

product appears to be a true colloid and it is claimed that the coal will remain in suspension indefinitely. The fuel is burned in B & W steam-mechanical, Todd steam-atomizing and Petro rotary-cup burners under two firetube boilers.

Unfortunately, facilities are not available for measuring power input to the grinding operation nor for making a full boiler test to determine combustion performance. The New York Ordnance Office, War Department, in collaboration with the Petroleum Administration for War, assigned Messrs W C Drake and Phillip O'Keefe to cooperate in operation and observation of this pilot plant.

The two installations just described represent two ways of preparing the colloidal-fuel mixture. Another method, using circulation to keep the coal in suspension, and thus most suitable for mixture at point of use, has been tried at the Pittsburgh refinery of the Gulf Oil Corp. A discussion of the test results by Alfred Butcher, Steam Engineer, appears in *Mechanical Engineering* of April, 1943. It is also reported that one of the major coal producers has carried out extensive experiments in the preparation and use of colloidal fuel, but so far no data have been made public.

It is still early to forecast probable future developments in this field. However, it seems fair to say, on the basis of present and past tests, that colloidal fuel can be produced that will remain stable for reasonable periods, without fixateurs. With today's fuel situation making hand-to-mouth operation necessary, ability to withstand storage becomes of considerably less importance. Furthermore, it seems fair to say that colloidal fuel can be burned in equipment designed for handling heavy oil and in furnaces that operate under reasonable conditions. If the coal used runs reasonably low in ash and high in fusion temperature, and if the boiler is not forced at high rates, no excessive slag or ash difficulties seem likely.

On the other hand, results in other types of burners, and in furnaces operated at high rates of heat release, are still in question. Only fairly long-term tests would reveal possible wear in pumps, valves, fittings and burners resulting from abrasion of the coal particles.

Biggest single question mark seems

No Stalling on This Job

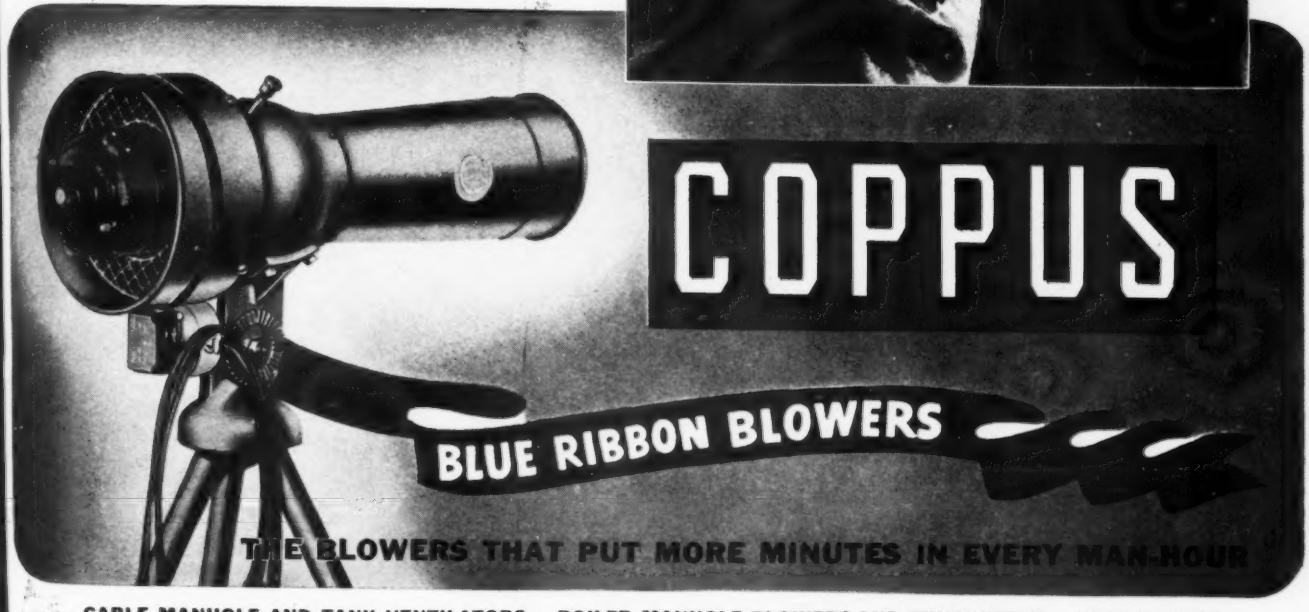
Pure, Cool Air from a Coppus Blower or Heat-Killer Prevents Costly Slumps in Worker Efficiency

In heat, in noxious fumes, production is bound to slow down — unless a Coppus Heat-Killer gives it a "lift" with healthy, stimulating air.

You can prevent suffocation-fatigue in tanks and underground manholes, in all confined spaces . . . heat-fag near furnaces, around hot processes . . . by installing Coppus "Blue Ribbon" Heat-Killers, Blowers and Exhausters for a steady current of cool, fresh air.

Your needs are different? Coppus Blowers and Exhausters are easily adaptable. Do you move from place to place? They are lightweight, portable.

And each one bears the Coppus "Blue Ribbon" mark of precision, strength and good workmanship.



CABLE MANHOLE AND TANK VENTILATORS — BOILER MANHOLE BLOWERS AND EXHAUSTERS — HEAT KILLERS — SHIPHOLD VENTILATORS . . . DESIGNED FOR YOUR INDUSTRY — ENGINEERED FOR YOU

MAIL THIS COUPON To Coppus Engineering Corp., 306 Park Avenue, Worcester, Mass. Sales offices in THOMAS' REGISTER. Other "Blue Ribbon" Products in SWEET'S Catalog.

PLEASE SEND ME INFORMATION ON SUPPLYING FRESH AIR TO MEN WORKING:

- ☐ in tanks, tank cars, drums, etc.
- ☐ in underground cable manholes.
- ☐ in aeroplane fusilages, wings, etc.
- ☐ on coke ovens.
- ☐ on steam-heated rubber processes.
- ☐ on boiler repair jobs.

COOLING:

- ☐ motors, generators, switchboards.
- ☐ wires and sheets.
- ☐ general man cooling.
- ☐ around cracking stills.
- ☐ exhausting welding fumes.
- ☐ stirring up stagnant air wherever men are working or material is drying.
- ☐ drying of walls, sheets, etc., after treated with coating material.

NAME .....

COMPANY .....

ADDRESS .....

CITY .....

(Write here any special ventilating problem you may have.)

USE OF PROPER METAL

CUTS BEARING FAILURES TO A MINIMUM

Bearing failures can be reduced to a minimum by using a metal that has been "alloyed" specially for the particular application. No one bearing alloy incorporates all the physical characteristics needed to meet all possible working conditions. Average conditions call for good resistance to compression plus excellent anti-frictional qualities. Under extreme conditions some of the anti-friction qualities must be sacrificed to obtain either malleability or hardness. Of the five Magnolia Bearing Metals listed below ONE is RIGHT for your application.

PHYSICAL CHARACTERISTICS

BEARING METAL	ULTIMATE STRENGTH lb. per sq. in.	YIELD POINT lb. per sq. in.	BRINELL HARDNESS	POURING RANGE deg. Fahrenheit
ADAMANT Super-Genuine	12,850	8,625	22.8	875-1050
DEFENDER	16,100	7,685	19.5	850-900
MAGNOLIA Anti-friction	17,500	5,440	21.8	825-900
POWER Nickel-Genuine	17,500	10,850	27	900-1000
PYRAMID	17,850	8,875	24	875-1000

80% of bearings in use today are subject to uniform speed and only moderate pressures, as in electric motors, line shafting and general machinery. For such services, use Magnolia Anti-friction Metal.

When bearings are subjected to heavy sustained pressures, such as in rolling-mill machinery, use lead-base Pyramid or tin base Power, hard metals which will not squeeze out.

For shock loads, which would crack the harder bearing metals, use lead-base Defender or tin-base Adamant, tough yet malleable metals. Internal combustion engines and trap rock crushers are typical applications.

GENERAL USE

HEAVY LOADS

SHOCK LOADS

REG. U.S. PAT. OFF.

NEW BULLETIN

Write for FREE 8-page bulletin which shows what bearing metal to use where and gives many helpful hints on how to keep bearings on the job.

MAGNOLIA METAL CO.• ELIZABETH, N. J.

MAGNOLIA BEARING METALS

to be that of cost. The cost of raw materials going into a bbl of colloidal fuel is somewhat less than that of a bbl of No. 6 oil and the colloidal fuel has from 1 to 4% higher heating value per bbl. Out of this margin must come the cost of grinding the coal and preparing the mixture, as well as fixed charges on the plant required. Reliable information on cost of grinding may be expected soon and since this represents the major operating cost, availability of test data will permit sound estimates to be made.

Based on operation of a plant using a colloidal mill, the PAW report previously mentioned estimates that a plant able to produce 300 tons of colloidal fuel daily would cost $125,000. Operating-cost estimates indicate that a colloidal-fuel plant would return sufficient net earnings above cost to carry the complete investment involved. Consequently, the report states, no consideration has been given to any form of government subsidy for the petroleum marketer or the individual industrial plant that might undertake such an operation. The Marketing Division, PAW, is, however, handling the details looking to the granting of government loans to be amortized on a 10-year basis, with interest not to exceed 6 percent per annum.

PAW's Suggested Program

To cut annual fuel-oil consumption in Districts One and Two by the 15,000,000 bbl, which the previously mentioned estimates indicate can be saved by full use of colloidal fuel, would require about 25 colloidal-fuel plants of 300 tons daily capacity. While the PAW report emphasizes that location of these plants depends on action of petroleum marketers who would build and operate these plants, it suggests that three plants each be built in New York and Chicago, and two each in Boston, Philadelphia, Pittsburgh, Baltimore, Detroit, St. Louis and Kansas City. The remaining five, it is suggested, might be built by large industrial companies for their own use.

To sum up: It looks as if the next few months will see release of valuable data on practical features and costs of colloidal fuel. If such a substitute fuel can be produced at a price not too far out of line with cost of No. 6 oil, facilities for production and distribution may be set up in time to provide some fuel for next winter. Accumulation of experience with colloidal fuel will indicate whether it will play any part in the future after its immediate potential service as an "oil extender" in the present emergency.

WILSON TRIGGER POWER CLEANERS FOR SMALL HEAT EXCHANGER TUBES

Send for a copy of this six-page bulletin fully describing this new and revolutionary type of tube cleaner for cleaning 3/8" I.D. to 1¼" I. D. straight tubes.

THOMAS C. WILSON, Inc.

PIPE AND TUBE CLEANERS EXCLUSIVELY

THE WILSON BUILDING

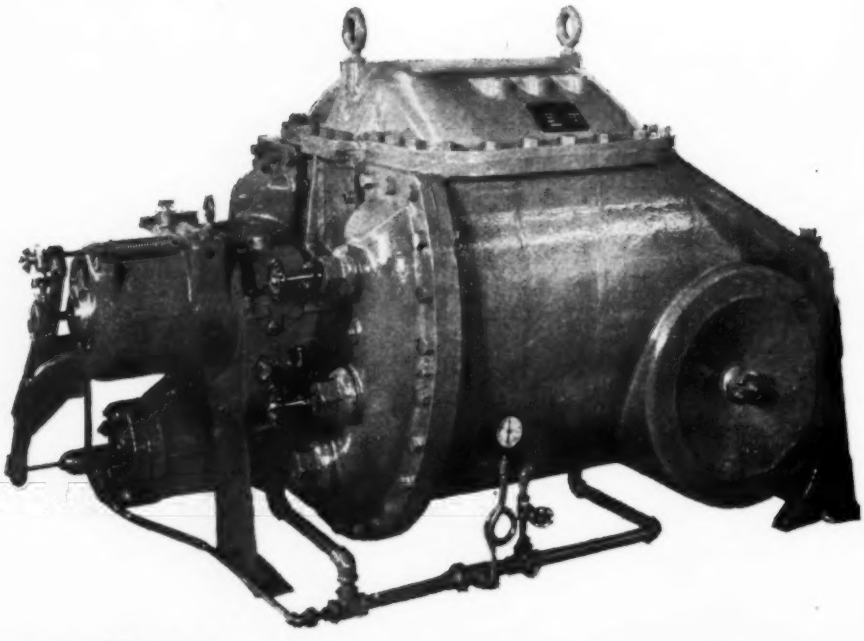
1-11 44TH AVE. LONG ISLAND CITY, N. Y.

MURRAY
TYPE UV
Multi-stage
MECHANICAL DRIVE TURBINE

★ The "UV" Multi-stage Turbine parallels the design of the Type "U" Single Stage Turbine. It has the same unique and patented arrangement of the casing which is split horizontally well above the shaft centerline. This construction provides a longer steam ring with greater nozzle area and larger steam inlet size, larger exhaust opening, additional hand valves and improved efficiency.

View shows the unit equipped with mechanical shaft type main speed governor and hand speed changer. Also shown is the standard center line exhaust end support and flexible steam end support.

The "UV" turbine can also be provided with oil relay governor either of the constant or variable speed type as well as extraction or extraction mixed pressure gear.



MURRAY
IRON WORKS COMPANY
INCORPORATED 1870
BURLINGTON IOWA

Compressed Air

(*Continued from page 77*)

Fourth: After determining size, kind and number of units, location becomes an important factor. But before deciding on it, consider three pertinent points: (a) soil conditions for foundations, (b) ease of inspection and maintenance by operating personnel, and (c) distances that pipelines must run.

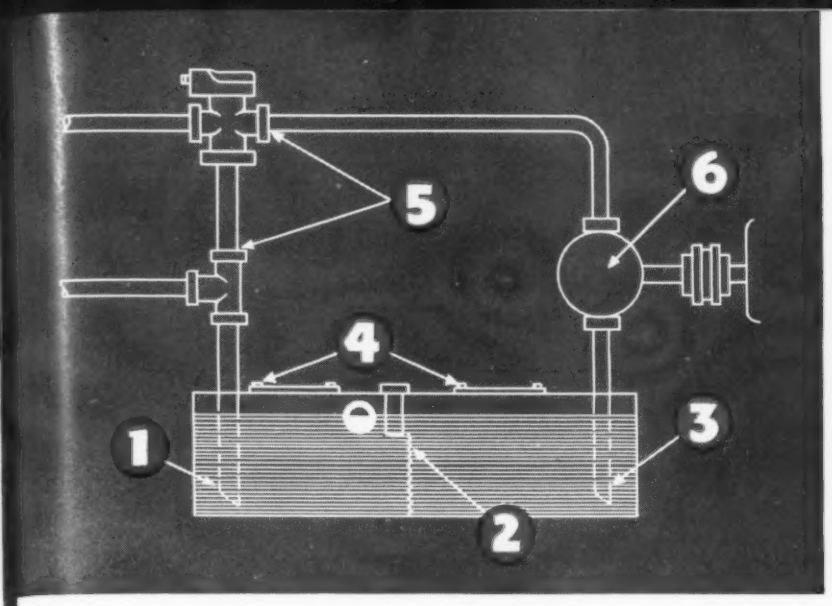
Soil conditions must be known not only to pour the correct foundation mass, but also to assure the proper foundation arrangement for balancing the compressor itself. On normal, firm soils, no special precautions are necessary. However, numerous installations are made in upper floors of buildings or, quite often, on filled land with piling driven in to support the foundation.

Balance Forces

In such locations the major shaking forces, which exist in all reciprocating compressors, should be so balanced that their greatest effects are in the vertical plane with the minor forces acting in the horizontal plane. As these forces not only depend on the weights of the reciprocating parts, but also vary as the square of the speed, a slight change in operating speed often corrects serious vibration. When no shaking forces in either the horizontal or vertical planes can be tolerated, a so-called balanced, opposed unit, Fig. 1, fills the requirements. Acquainting the compressor manufacturer with all particulars covering soil conditions encourages him to make suitable recommendations for foundation construction.

It is a universally accepted fact that making it easy for an operator to inspect a machine gives it a better chance of receiving proper attention. Although air compressors do not require constant attention, they should definitely receive periodic inspections on a regular maintenance schedule to give longest and most efficient service.

Consider length of pipe runs from the standpoints of installation cost and possible pressure loss. All lines should be of such size that pressure loss does not exceed 2 psi between compressor and point of use. Pressure losses in excess of this are an expensive luxury because they reduce the equipment's productivity and increase power cost for compressing air. This amounts to 2% of the current yearly bill for each 5-psi pressure loss.



Hydraulic Oils and how to select them

Troubles in hydraulic system operation are not always caused by the oil used, but many of them can be avoided by using the right oil. Here are some suggestions for selecting the right hydraulic oil:

WHAT TO AVOID

Viscosity too high. Most easily detected when starting the unit, by sluggish operation and delayed circulation, which may damage the pump. When operating, too high a viscosity may cause over-heating and rapid oil oxidation. **Viscosity too low.** Indicated by low pressure, erratic operation. It frequently causes leakage at packings and glands. Excessive wear may develop because lubrication is inadequate.

Poor stability. Conditions under which hydraulic oils operate (heat—pressure—aeration) tend to cause the oil to oxidize and form deposits in the system. These deposits cause wear on pumps and valves, and erratic operation, which can only be corrected by an expensive cleaning operation. Deposits caused by oil oxidation should not be confused with those caused by contaminants entering the hydraulic system.

Poor demulsibility. Although normal precautions are taken to keep moisture and coolants from entering the hydraulic system, some oils will emulsify in the presence of even a small amount of moisture. The resultant frothy mixture is compressible, causing a loss of pressure and poor control of operation.

WHAT TO LOOK FOR

High Viscosity Index. Hydraulic pump and motor manufacturers have definite viscosity recommendations for oil used in their equipment. But for further protection, you need an oil of *high viscosity index*—an oil that resists changes in viscosity with changes in operating temperatures. Stanoil, for example, flows readily at starting, yet maintains suitable viscosity at the required operating temperatures.

High stability. There are many reasons why oils oxidize. Briefly, petroleum consists of various hydrocarbons, some of which unite readily with oxygen. This is called oxidation. The problem is to remove these unstable hydrocarbons. This has been accomplished in Stanoils by a unique refining process. Frequent cleaning of oil system, and oil changes necessary because of oil oxidation, are materially reduced with Stanoil.

Ease of separation from water. An oil must have good demulsibility—must separate readily from water so it will not form oil and water emulsion. Stanoil has this quality. With reasonable care to keep out dirt, Stanoil will not emulsify and can easily be separated from any water in the system.

These are just a few points to check in choosing a hydraulic oil. Let a Standard Lubrication Engineer help you pick the right grade and type of oil for your specific hydraulic jobs. Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago, Illinois, for the Engineer nearest you.

Tips on a typical hydraulic system installation

1. **Oil return line** must discharge below oil level to prevent formation of air bubbles which would cause erratic operation of the pump.

2. **Baffle plate** installed between intake and return discharge helps settle out any dirt in the system and remove air bubbles introduced when filling.

3. **Oil intake pipe** should extend to within two diameters of the bottom of the reservoir, to reduce the possibility of air entering the system if the oil level is low.

4. **Hand holes** are recommended to facilitate inspection of oil and cleaning of oil reservoir, but they must be tightly sealed to prevent entrance of contaminants and water into the system.

5. **Pipe joints** should be made positively leakproof to prevent entrance of water or air and the loss of oil and pressure.

6. **Hydraulic pumps** are accurately machined units. Their continuous, efficient operation depends upon how this accuracy is maintained. The best installation can be a continual source of trouble unless a clean oil of high quality, high stability, and the right grade, is used.

Oil Is Ammunition . . . Use It Wisely

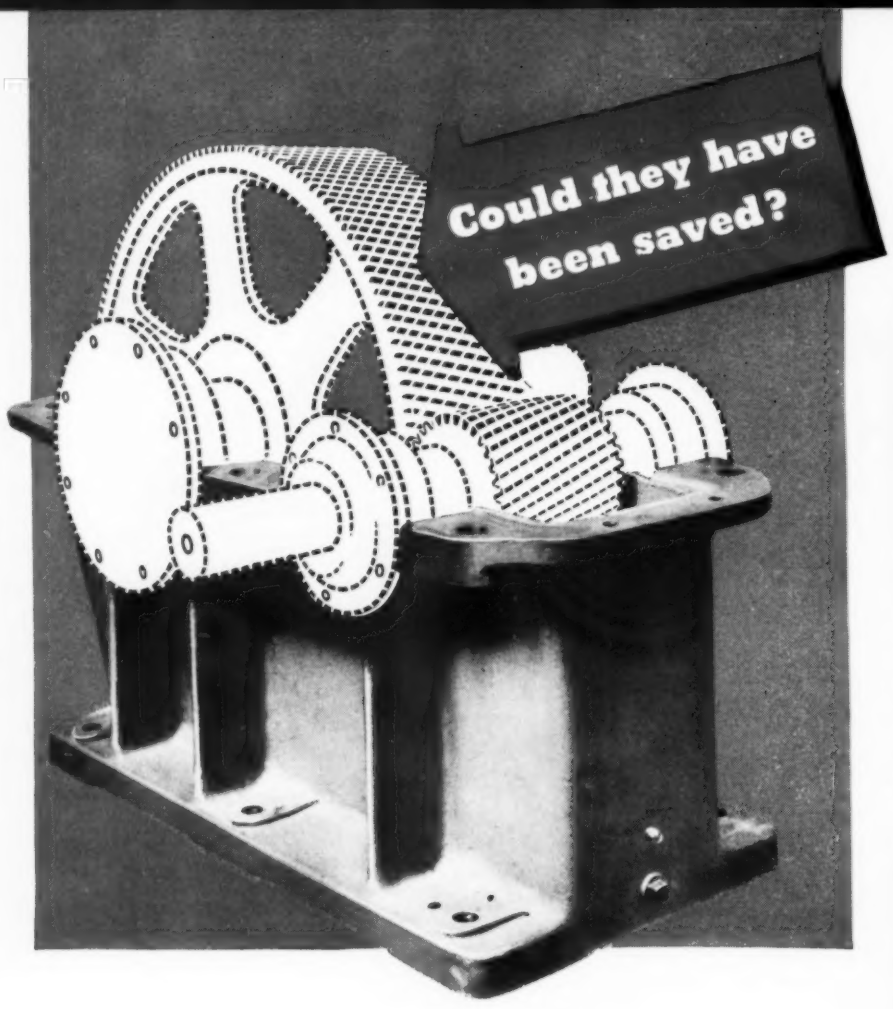
STANOIL

LUBRICATION ENGINEERING

STANDARD OIL COMPANY (INDIANA)

••LUBRICATION ENGINEERING••LUBRICATION ENGINEERING••LUBRICATION ENGINEERING••LUBRICAT

RICATION ENGINEERING • • • LUBRICATION ENGINEERING • • • LUBRICATION ENGINEERING • • • LUBRICATION EN



Gear wear and what you can do to reduce it

GEAR WEAR is described by many terms—pitting, spalling, scoring, galling, scuffing—but by any name it all adds up to high maintenance, lost machine time, and replacement headaches.

Today, much of your power transmission equipment is operating at full-load—if not overloaded. That means, first, that more frequent inspections are needed, particularly on enclosed gears and bearings, to detect wear before serious damage is done.

Second, these new operating conditions may require more frequent lubricating schedules or even new types of lubricants. It's a good time to check these points thoroughly before they show up in excessive wear.

Signs of gear wear, and the cause, are easily recognized in many instances. A few are pictured and described at the right. But determining the cure is not always simple.

Why not do the whole job at once—check equipment for excessive wear, check lubricating schedules and lubricants—by having a Standard Lubrication Engineer help you make an inspection of this equipment. He has done this in other plants and has made many valuable suggestions. It will take very little of your time and will cost you nothing. Call any local Standard Oil Company (Indiana) office, or write 910 South Michigan Avenue, Chicago, Illinois, for the Engineer nearest you. In Nebraska, call any Standard Oil Company of Nebraska office.

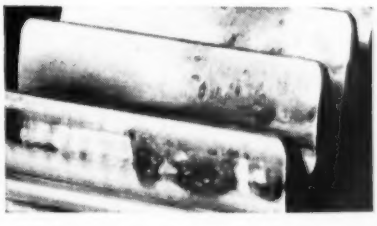
OIL IS AMMUNITION . . . USE IT WISELY

Typical examples of gear wear

Pitting is of two types: (1) Corrective pitting—occurs when gears are first operated, caused by high spots in gear finish. When high spots are eliminated pitting stops. (2) Destructive pitting, illustrated above—occurs when pitting continues until the contacting surfaces are destroyed.

Watch for signs of pitting on new gears. Prevent it from reaching the destructive stage by truing up contact surfaces and applying more effective lubricant.

Abrasion: Generally distinguished by radial scratches on the teeth. In enclosed gears, use greater care in handling lubricants and filling gear cases to prevent entrance of grit and dust. On open gears in dusty conditions, use non-sticky gear compound to reduce abrasion.



Scoring and galling: Different degrees of the same type of wear. Scoring is scratching, grooving, or roughening of tooth surface. Galling, shown above, is seizing or tearing of the surface as the result of continued scoring. Causes: Excessive pressures, rough surfaces, foreign matter, or inadequate lubrication. Analyze any scoring, and correct it before galling occurs.

These are but a few examples. A Standard Lubrication Engineer can help you determine the cause of many types of gear failure and suggest ways to prevent them.

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

TAKE CARE OF YOUR DIESEL

★ ★ ★ Many parts of your Diesel are manufactured of critical materials—materials that are most difficult to obtain even with the highest of priorities. Therefore now, as never before, the full efficiency of your Diesel should be maintained by proper care and attention. Lessened power, lost time and wasted money are the least of the inevitable results of laxness in engine maintenance.

Superior Diesels, sturdy and rugged as they are, nevertheless require regular attention—just as any other precision machinery. In order that you may obtain the full measure of service they were designed to deliver, and at the same time help us to conserve the vital materials necessary to replace parts needlessly broken or worn out, we ask that you:

1. Avoid continuous overloads.
2. Use only clean fuel and high quality lubricants.
3. Keep all filters clean.
4. Replace worn or stuck piston rings at once.
5. Grind valves and check clearances regularly.
6. Maintain proper clearances of main and connecting rod bearings.

SUPERIOR ENGINE DIVISION

THE NATIONAL SUPPLY COMPANY

SALES OFFICES: Springfield, Ohio; Philadelphia, Penna.; New York, N. Y.; Los Angeles, Calif.; Chicago, Ill.; Jacksonville, Fla.; Houston, Texas; Fort Worth, Texas; Tulsa, Okla.; Boston, Mass.
FACTORY: Springfield, Ohio

The Camera proves it!

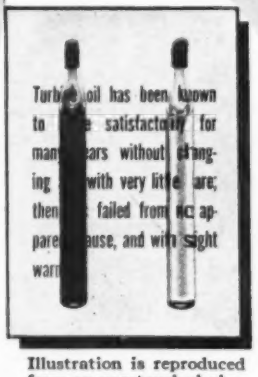


Illustration is reproduced from an unretouched photograph. Pencil bottle at the left shows oil actually taken from an operating Turbine—bottle at right shows same oil after purification through a Honan-Crane "*Continuous*" Oil Purifier.

1. That a Honan-Crane "*Continuous*" Oil Purifier really removes all of the dirt and contamination from Turbine oil. It will remove abrasives, sludges, acids and all other dangerous contaminants. See picture at left.

2. It is dirt and contamination that causes trouble in Turbine oil. Eliminate these impurities and your oil will do a perfect job:

For instance—water in Turbine oil is an undesirable condition.

But—it is a simple problem to get rid of water from clean or purified Turbine oil with a properly controlled emulsion number . . . even while the oil is in use.

Whereas—it is almost impossible to remove the water from contaminated oil—it must at least be removed from the Turbine and subjected to a severe processing.

These Three Unretouched Pictures Graphically Show the Relative Problem of Water Separation in Both Dirty and Clean Turbine Oils

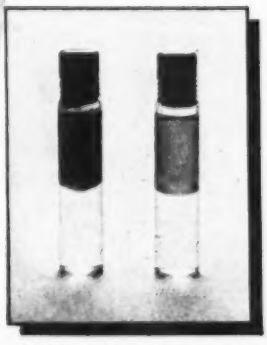


FIG. 1—Picture shows the same turbine oil—bottle at left contains dirty oil as taken from Turbine in operation—bottle at right contains same oil after purification by a Honan-Crane "*Continuous*" Oil Purifier. Both bottles contain the same amount of water.

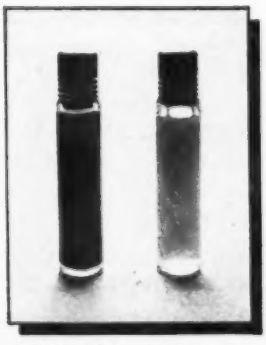


FIG. 2—This picture was taken after both bottles were heated to 120° F. and shaken hard to thoroughly mix the oil and water. Despite the fact that this picture was taken almost instantaneously—the water had already started to drop out of the clean oil.

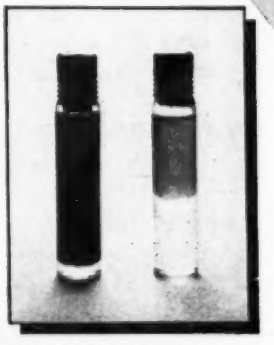


FIG. 3—This picture taken at an interval of 3 minutes—the water has completely dropped out of the clean oil—whereas it has not fallen out of the dirty oil to any appreciable extent. After 3 hours, water level in the dirty oil had not changed to any perceptible degree.

Any water released in a Turbine while in operation (providing the oil is clean with a proper emulsification number) can be drained from the bottom of the sump without interrupting the operation of the Turbine.

As in the case of water—most problems with Turbine oil are quickly eliminated by proper oil purification as guaranteed by a Honan-Crane "*Continuous*" Oil Purifier.

For complete information write for Bulletin 300T

HONAN-CRANE CORP.
1200 SIXTH STREET, LEBANON, INDIANA

Leaders in Research and Manufacture of Oil Purification Equipment

Make the suction line as short and direct as possible, taking the air from outdoors through an efficient air filter. Using outdoor air means that for each 5 F drop in intake-air temperature the machine output increases 1% with no increase in the power required to compress the air. Therefore the cooler the air, the more efficient the compressor operation.

Elevator Accidents

(*Continued from page* 154)

from the car controller, then decided to take the car to the bottom landing for a missing part. Partially removing the disk cam closed certain contacts, and the car landed full speed on the buffers, instead of stopping when it reached the first floor. Fortunately, the terriffic reaction between buffers, car and counterweights did not part the cables.

Counterweights are always heavier than the modern car, so unless they are at bottom of hoistway resting on a timber, never remove brakeshoes: On one of the high-speed elevator machines in an office building, a mechanic was relining the brakeshoes. He released them without lowering the counterweights on a timber in the bottom of the hoistway. Consequently, the car started to coast upward. Panic-stricken, the mechanic threw a heavy piece of timber into the hoisting drum's spokes. Jamming the machine stopped it and prevented serious accident. The strain on the spokes could easily have wrecked the drum, cut hoisting cables and let both car and counterweight drop.

Operator must carry out orders faithfully during inspection: Inspectors have been seriously injured or killed by being jammed between car top and overhead work, either because car ran above top floor or because of close clearance above top floor. Similar accidents have occurred in the bottom of the hoistway where clearance between car and pit bottom was close, and there were no bumpers under the car.

Objects fall down hoistway when construction or repairs and adjustments are under way: Such objects may range from light parts to an elevator machine weighing several tons. Once an elevator machine rolled into the hoistway from the 45th floor and in its fall killed four workmen. Another car caused a serious accident when it came down the hoistway and hit some of the counterweight sections that were not properly secured. The sections dropped out and fell into the car, killing the two occupants.

At night on a lonely beach

Landing boats and tank lighters are grounding on the beach and our army is establishing a beach head. This scene has been enacted at Guadalcanal — in North Africa and at little-known harbors in New Guinea.

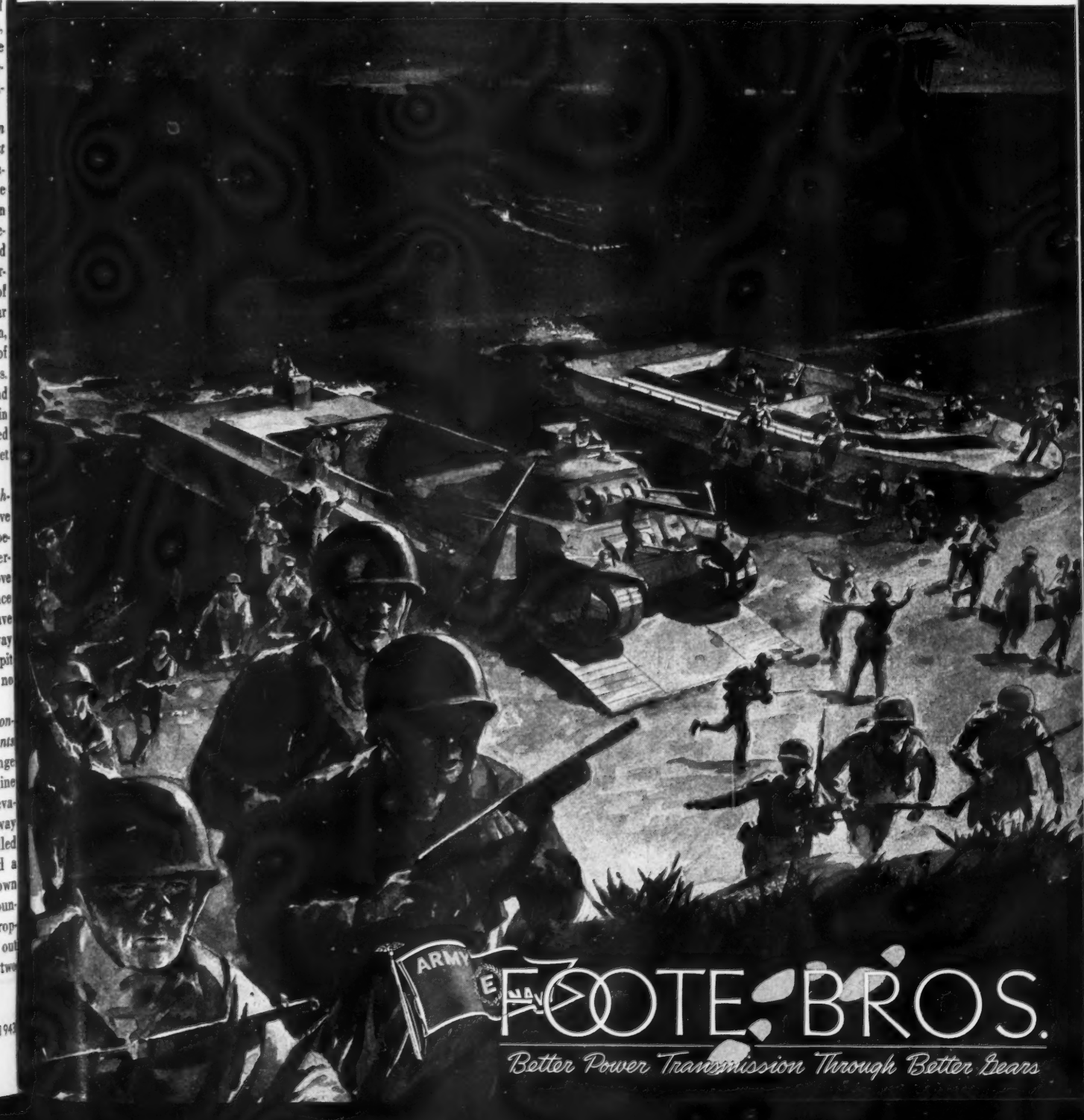
Dim shadows—low on the horizon—waves foaming on a sandy beach—then pushing through the darkness, landing barges bring threat of invasion to Axis-ruled lands!

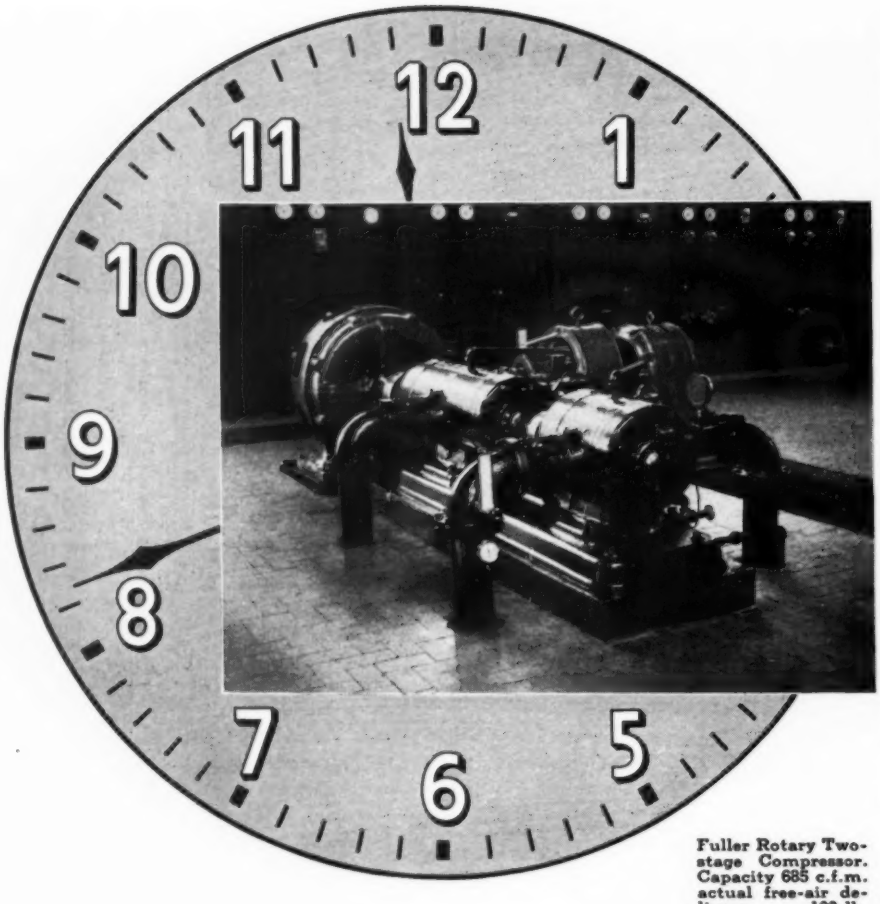
Built to battle pounding surf—made to stand the jarring impact of landing—tough is the word for these barges. And tough is the word for the giant gears that drop their anchors and raise them. In fact, so tough are the blanks for these gears that cutting them was deemed an impossibility. Foote Bros. engineers and Foote Bros. workmen changed the conception of what was possible. And today, the landing barges which are keeping Hitler's armies pinned to the coast from Narvik to Tripoli give evidence of how well these special problems were solved.

Here at Foote Bros. new techniques and new manufacturing know-hows are responsible for gears and speed reducers of radically different design and construction—gears light in weight and of extreme precision for aircraft engines—gears of giant size and super toughness designed to stand the grueling punishment that only war can give.

But when the war is won and these same techniques can be applied to peacetime use, American manufacturers may look forward to revolutionary developments in all phases of power transmission.

FOOTE BROS. GEAR AND MACHINE CORPORATION
5225 South Western Boulevard • Chicago, Illinois





Fuller Rotary Two-stage Compressor. Capacity 685 c.f.m. actual free-air delivery. 100-lb. pressure.

'Round the Clock Performance . . . Fuller Rotaries Give it to You

'Round the clock, 24 hours, day in and day out service with comparatively little shut-down or maintenance expense. That's why plant superintendents and maintenance men like Fuller Rotaries.

Performance records show they're truly the economical unit to install . . . in a foundry $3.90 for repairs in three years; in a patent fastener plant, four years' operation: "It has run 23 hours per day almost continuously and has given no trouble." Not a cent was spent for repairs during these four years.

FULLER ROTARY COMPRESSORS AND VACUUM PUMPS — BUILT FOR CAPACITIES TO 1800 C. F. M. PRESSURES TO 125-LB. VACUUMS TO 29.90-IN. REFERRED TO 30-IN. BAROMETER

Repeat orders also tell a conclusive story. A steel company purchased its first Fuller in 1939 and to date has installed 14 machines. An oil company has purchased 31, a cement company 28, machinery manufacturer 27, soap manufacturer 17.

Get acquainted with Fullers. Write for new Bulletin C-5 . . . it's yours for the asking.

C-76A

FULLER COMPANY
CATASAUQUA—PENNSYLVANIA
CHICAGO—Marquette Bldg. SAN FRANCISCO—Chancery Bldg.

Readers' Problems

(*Continued from page* 113)

Boiler Inspection Department for expert decision.

Determination of embrittlement is a laboratory problem for an expert metallographer, not one for the operating engineer. The experienced boiler inspector may recommend the course of investigation.

Several leading feedwater laboratories are equipped to install Schroeder or Straub embrittlement detectors to show whether the boiler water is embrittling in character. There is absolutely no known manner in which the operating engineer can decisively detect embrittlement in its early stages by visual examination of the boiler.

Canton, Mass H M SPRING

Risk At High Pressure Too Great

THE VERDICT of the insurance company is based on the possible fatigue of the boiler shell metal. The boilers have not reached this point yet because the company always allows a grace period of safe operation.

As new boilers may be impossible to secure at this time, the only logical thing to do is to change to motors for stokers and fans and reduce to the allowable working pressure of 15 psi. These boilers may run for a long time on 120 psi but the risk is too great. The explosion of a condemned boiler would bring serious law suits, and the damage would more than offset the cost of changing over; to say nothing of bodily injury or loss of life.

You can test for embrittlement by scraping the metal and inspecting with a strong magnifying glass for hair-line cracks.

Baltimore, Md. C W PARKS

Don't Violate Code Rules

CJJ DOES NOT INDICATE whether or not his boilers are located in a State having a boiler code governing the operation of high-pressure boilers. Insurance companies in such cases have no alternative but to be governed by the boiler code rather than by their own rules.

Another factor determining the maximum allowable working pressure is the type of longitudinal seams in the boilers referred to. For existing in-

"if you out-build 'em!"

Rat-tat-tat . . . and down goes another enemy plane! Our pilots and bombardiers have what it takes to out-blitz them.

It's our job back home ~~to~~ *out-build* the enemy. We're now doing it. Keep it up, America—work hard, avoid waste, buy more War Bonds!

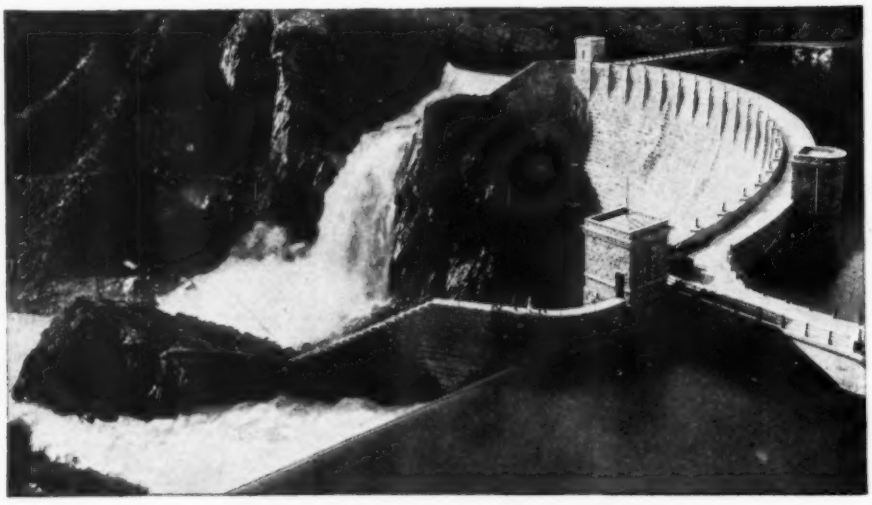
Garlock

THE GARLOCK PACKING COMPANY, PALMYRA, NEW YORK

Manufacturers of GARLOCK Packings, Gaskets and KLOZURE Oil Seals

In Canada: The Garlock Packing Company of Canada Limited, Montreal, Que.

Water IS *IDEAL* FOR ELECTRICAL POWER...but *NOT* for Electrical Equipment *FIRES*



THE ANSWER IS...

duGas

Fire Extinguishing Equipment

For fires in electrical equipment or inflammable liquids, duGas envelopes and smothers the flame in seconds...and it's a non-conductor. Adjacent equipment, not already damaged by fire or electrical breakdown, will not be harmed by duGas and can be put into service immediately. This is not true when water is used. DuGas stands guard for many utilities throughout the country. Names on request.

Available in Models 15 and 30 Hand Extinguishers...Models 150 and 350 Wheeled Extinguishers.

Write for details and priority information.

DUGAS ENGINEERING CORPORATION, MARINETTE, WISCONSIN

OWNED AND OPERATED BY ANSUL CHEMICAL COMPANY

REPRESENTED IN PRINCIPAL CITIES

DUGAS FIRE EXTINGUISHING APPARATUS IS APPROVED BY UNDERWRITERS' LABORATORIES, FACTORY MUTUAL LABORATORIES

stallations most boiler codes make a clear distinction between lap and butt-strap seams in determining the safety factor.

No information is given regarding boiler construction but judging from their age they probably have lap-riveted longitudinal seams. In that case some codes call for a factor of safety of 6 for boilers this old provided that a factor of safety of 5 may be continued if the boilers show no leakage or indications of distress after a thorough inspection and a hydrostatic test under the pressure required by the code rules.

The safety factor for old boilers is, in most codes, increased in steps of five-tenths for each five years of age, starting with 5 for boilers not over 20 years old. Therefore it is difficult to understand why the allowable working pressure on the boilers in question was reduced from 120 to 15 psi in one step. If the boilers were already operating with a safety factor of 6 the next step, to 6.5, would only effect a reduction of approximately 8% and still allow a working pressure of 110 psi.

In cases of boilers having butt-strap seams some codes allow the use of a factor of safety of 4¼ for boilers of any age over 20 years. These rules are inflexible and take into consideration only the age element; making no allowances for condition other than the hydrostatic test above mentioned. They are necessarily based on the average safe age of used boilers.

If the pressure on CJJ's boilers is being reduced in pursuance of the provisions of a boiler code it appears that he should first take the matter up with the proper authorities. Code rules should not be violated at any time as the seriousness of such action is readily apparent.

I S CHAMBERLAIN

Jersey City, N. J.

Lists Inspection Points

IF INSURANCE CARRIERS decline to permit more than 15 psi pressure on the boilers, there must be some fault other than age. CJJ should check his boilers for corrosion even if there is no evidence of embrittlement. He can do this by drilling a hole in the shell and checking the thickness of the plate against the original thickness. He should remove a few rivets and examine the walls of the rivet holes carefully for cracks, or signs of embrittlement. The tube sheet should be carefully inspected.

IRON FIREMAN

PNEUMATIC SPREADER STOKERS CARRY 175% OF BOILER RATING

at Indianapolis Drop Forging Co.

Plant of Indianapolis Drop Forging Co.
Indianapolis, Indiana

Fuel Savings Average Over $600 Monthly

★ According to Ferd Barnikol, Purchasing Agent, two Iron Fireman Pneumatic Spreader stokers are saving over $7000 annually at the Indianapolis Drop Forging Plant. Four 250 H.P. boilers are fired and carry a peak load of about 175% of rating—no small factor when wartime demands call for plus production. If you are not one of the many thousand now benefiting from Iron Fireman firing, consider changing to coal, fired by an Iron Fireman Pneumatic Spreader stoker. Get these advantages:

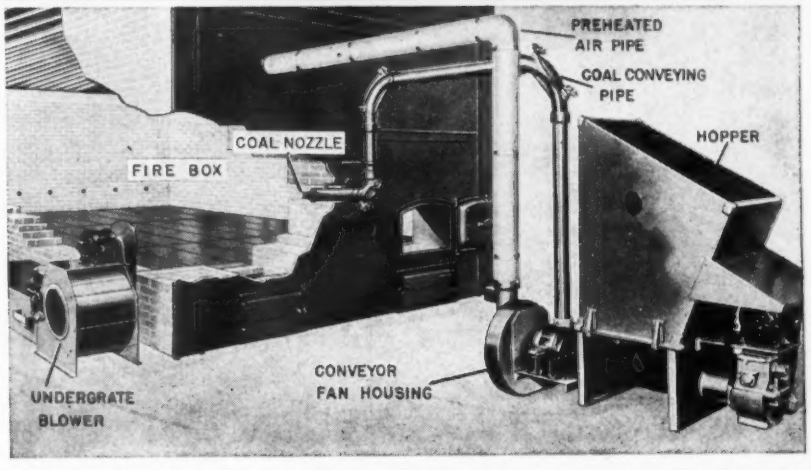
1. **Fuel Economy.** Burns efficiently such economical fuels as the lower grade bituminous coals and also sub-bituminous and lignite coals. Coal is conveyed and distributed on a stream of air or hot gases. The fines burn in suspension, utilizing the conveying air for combustion. The larger pieces form a shallow fuel bed on the grate.

2. **Flexibility of Installation.** Stoker can be located anywhere within a reasonable distance of the boiler front—either above, below, or on the same floor as the boiler.

3. **Ease of Operation.** Coal is automatically fed either from a large-capacity hopper or directly from the bunker. Automatic controls regulate its operation.

4. **Low Maintenance.** No moving parts are exposed to fire-zone. Grate design provides ample coaling. Lubrication system is positive and efficient. Users' records show very low maintenance costs.

5. **Reliability.** The Pneumatic Spreader stoker is an Iron Fireman product. Iron Fireman, "the machine that made coal an automatic fuel," is the world's standard in stokers.



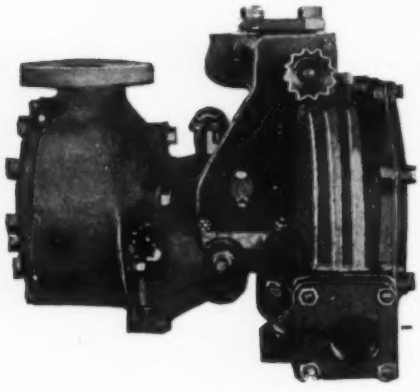
Diagrammatic view showing an Iron Fireman Pneumatic Spreader stoker installation. Steam-size coal is conveyed from the hopper or bunker to a transfer housing. Here the coal is picked up by a stream of air and carried to the furnace and grates. The fines burn in suspension. Heavier pieces create a fire bed, with forced air fed from below.

Iron Fireman Stokers Now Available

Learn what Iron Fireman firing can accomplish for you. We are ready to make an immediate engineering survey of your plant, in cooperation with your own engineers. No cost or obligation. Write Iron Fireman Manufacturing Co., 3503 W. 106th St., Cleveland, O.

IRON FIREMAN AUTOMATIC COAL STOKERS

The
COFFIN-Steam Turbine
CENTRIFUGAL PUMP



A
SINGLE STAGE
HIGH PRESSURE
UNIT
for
BOILER FEED
and
GENERAL PRESSURE
SERVICE

●

SAVES SPACE
SAVES STEAM
SAVES SHUT-DOWNS

PRESSURES
To 750 Lbs. Sq. In.

DELIVERIES
To 500 G.P.M.

THE J. S. COFFIN, JR., Co.
ENGLEWOOD, N. J.

If there is no evidence of pitting, embrittlement, or uniform corrosion, and if the boiler is sound so far as tight rivets and flues are concerned, it should be safe to operate the boilers at 120 psi. A hydrostatic test pressure 25% above the working pressure should be applied before building up steam pressure. If CJJ expects to renew the boilers after the war it would not pay to change to motor drive for pumps and forced draft fans, because his new boilers might require larger auxiliaries, but if he plans to leave his present boilers as they are for an indefinite time it would be economical to switch to motor drive.

Parr, S. C. V C SUMMER

Real Cause May Be Riveted Joints

CJJ's BOILERS would now be about 34 years old. In those days manufacturers used a few methods which at the present time would not be tolerated—that is, punched rivet holes, unground rivets and outside caulking—just a few of the practices which are frowned upon in present day boiler shops.

The variation in stresses during 34 years of operation must have caused some weakening of the plate. The real trouble, however, would lie in the condition of the riveted joints. Sample rivets should be removed and holes examined. Areas under rivet heads should be examined for corrosion or pitting. Over-caulking of plates would be another defect to be considered.

Regarding embrittlement, if the boilers are in a locality where special precautions must be taken against this condition, a sample strip could be cut from the plate and sent to the laboratory for the etching test.

Finally, if after thorough inspection CJJ is convinced the boilers are in good shape, he might contact some other insurance company.

Galt, Ontario H PARKINSON

Boilers Must Be A Bad Risk

WHEN INSURANCE CARRIERS decline insurance on CJJ's boilers above 15 psi they must, in the inspector'c opinion, be a bad risk. Apart from the risk involved to themselves, the insurance company takes into consideration the danger to life and property. However CJJ should consult the local authorities governing the inspection of boilers and accept their decision as

Your Blueprint for
MORE POWER
starts with
OAKITE CLEANING

. . . Improving
Heat Transfer of Your After-Coolers Easily

Nothing interferes more with the efficiency of air compressors than the accumulation of scale in after-coolers and inter-coolers. By retarding heat transfer and impairing cooling water flow, such deposits seriously decrease operating efficiency and capacity. Thorough cleaning and descaling is the only solution.

But because of the trouble involved with the usual mechanical practices, such cleaning has often been postponed too long. Specially designed Oakite materials, however, do this work EASILY, QUICKLY, THOROUGHLY . . . and SAFELY. No dismantling of equipment is necessary. Merely circulating the recommended Oakite solution as directed removes lime-scale and other deposits.

NEW DIGEST FREE!
Gives details on this and 53 other important maintenance jobs. Write for your FREE copy TODAY!

OAKITE PRODUCTS, INC.
23 Thames Street, New York, N. Y.
Technical Service Representatives Located in All Principal Cities of the United States and Canada

OAKITE
Specialized cleaning
Buy Bonds for Victory
MATERIALS & METHODS FOR EVERY CLEANING REQUIREMENT

—another reason why rubber *must* be conserved!

BEFORE the advent of de-icers, nothing struck deeper terror to a bomber pilot's heart than the dread "ice forming on wings." So serious was this menace that in a matter of minutes there was often only the choice between a jump and a crash. Today—pulsating rubber on the leading edges of plane wings and tails breaks up ice as fast as it forms.

It's to provide rubber for de-icers and scores of other military needs that our scanty stock pile must be conserved to the utmost. If you use Multiple V-Belt Drives, you can help—*you must help*—by getting the utmost in service life from every belt in your plant.

This is important because more war material producing machines are driven with Multiple V-Belt Drives than any other type of power transmission. "23 WAYS TO CONSERVE THE LIFE OF YOUR MULTIPLE V-BELT DRIVES," prepared by the Engineering Research Bureau of the Association, tells how and why. Study it carefully and apply the recommendations to save rubber and reduce operating expense.

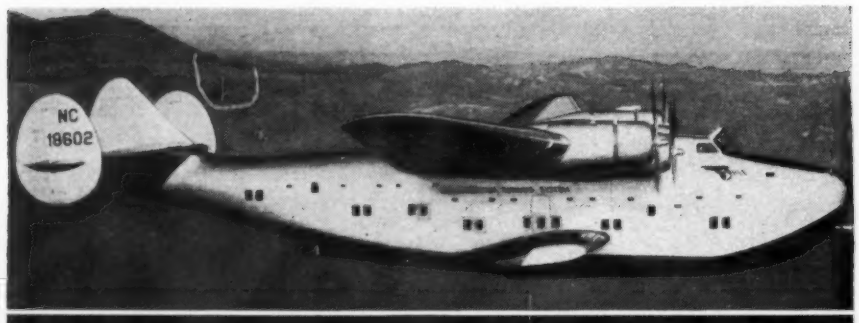
TRADE MARK

The use of this emblem by an association member in connection with Multiple V-Belt Drives is your assurance of mechanical excellence . . . the result of cooperative engineering, research and experience.

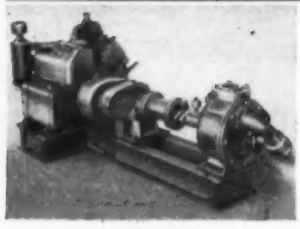
MULTIPLE V-BELT DRIVE ASSOCIATION

140 SOUTH DEARBORN ST., CHICAGO

Write for this FREE Association Book Today!



VIKING . . . . A Member Of Pan American's "Ground Crew"



● At bases throughout the world, Viking Rotary Pumps, in ever increasing numbers, are employed as a part of Pan American Airways "ground crew" to insure fast, efficient refueling of giant Clipper planes, now performing vital service to speed Victory for Uncle Sam and our Allies.

The special 150 GPM unit for Pan American, pictured at left, includes gasoline engine, double reduction gearing, firewall sleeve and Viking Rotary Pump with valve on head, all mounted on a structural steel base.

When you are unable to get pumps at all . . . or to secure them only after considerable delay . . . please remember that Viking is busy today with many War-time jobs . . . that production for Victory COMES FIRST . . . so that our Fighting Yanks can get back home.

VIKING PUMPS — FIRST IN AMERICA

VIKING Pump COMPANY
CEDAR FALLS, IOWA

ANSWERS

ALLEN-SHERMAN-HOFF ADVERTISEMENT

On Inside Front Cover

GROUP 1

Q 1 The Allen-Sherman-Hoff Co., Philadelphia.
Q 2 1927 in the Charles R. Huntley Station of the Buffalo General Electric Co., Buffalo, N. Y.
Q 3 Any other.
Q 4 From 2 tons per minute down to ½ ton per minute, depending on final disposal.

GROUP 2

Q 1 A dust handling valve which is generally open at all times so that the dust continuously drops from the hopper into the water in the valve (hydromixing). The mixture flows out through a pipe line.
Q 2 A vacuum producing unit in which high velocity water streams produce the vacuum for removing dust from Windswept Valves located throughout the power plant.
Q 3 Pipe to sump inside the plant and remove by pumping to fill, generally along with ashes.
Q 4 Hydromix Valve because continuous operation prevents coking in hopper.

GROUP 3

Q 1 Sluicing to adjacent fill or pumping to distant fill.
Q 2 One cent.
Q 3 Hydroseal Pump.
Q 4 Clear water flow in annular clearances (hydrosealing) between the rotating impeller and the stationary pump side plates to prevent abrasive laden water from enlarging these clearances on which pumping efficiency depends. Also, rubber protection (Maximix) on pump side plates.

GROUP 4

Q 1 Pump to overhead storage bin (Hydro-Bin) and unload through gate.
Q 2 Because water drains from the bin through the trough at one end of the A-S-H Type "C" Ash Gate, dehydration is simple and complete, and steam manifolds around the gate prevent freezing.
Q 3 Yes, by overflowing it into a surge tank.
Q 4 Hydroseal Recirculating Pump.

Make Your Overhead Valves SAFE And Easy to Reach---

With the Babbitt Rim for Valves you eliminate danger and banish the step ladder. You can now place your valves wherever they come economically and conveniently. They fit any valve. Let us tell you more about them. Write today.

BABBITT STEAM SPECIALTY CO.
New Bedford, Mass.

final. He says there is no evidence of embrittlement and that inspection shows the boilers to be in first class condition, yet he asks if there are any means of determining embrittlement areas. Embrittlement appears along the seams and if any part of the boilers is affected it is sufficient reason to reduce the pressure below 120 psi.

If CJJ is permitted to operate his boilers below 120 psi the rating at which they run will determine the efficiency. At high rating an hrt boiler is not very efficient, because high ratings produce high gas velocities in the tubes, and the gas leaves the boiler at high temperatures.

New York, N. Y. P DONOHUE

Study Complete History

WHETHER OR NOT CJJ can expect further service from his boilers at 120 psi will depend on their complete history. The chief items to be considered are: (1) Has feed water always been deaerated? (2) Has water treatment been adequate to prevent scale formation which would cause overheated metal? (3) Has gas, oil, or organic matter been present in appreciable quantities? (4) Is the feedwater of a character that has caused embrittlement troubles in the district? If this is so, have the boilers ever developed leaks which would allow concentration of solids in seams? (5) Have the boilers and settings been well maintained to prevent abnormal temperature conditions such as caused by flame impingement or excessive cold air leakage? (6) Has the rate of operation been kept within reasonable limits? (7) What parts have been replaced since 1909 and what caused their failure? (8) Has the pressure been cut before and for what reason?

There would seem to be two possible courses to follow, in addition to the one suggested by CJJ, namely:

(1) Replace the boilers with new units or used boilers that will meet the inspector's approval. (2) The inspectors may allow him to have defective or doubtful parts replaced to restore pressure rating. Parts removed can be examined and tested as necessary to demonstrate exact metal condition.

St. John, N. B. C G CLARK

Safe Life Span Is Over

CJJ HAS JUST COME face to face with the hard fact that his boilers have completed what is recognized as a safe span of life for that particular

In War Industries and in Power Plants
In Fighting, Transport and Merchant Ships
In War Transportation, Locomotives and Other Units

GLOBE STEEL TUBES IN GLOBAL-WAR SERVICE

The "emergency" found *Globe Steel Tubes* prepared...prepared because *Globe* engineers are veterans of more than 30 years' constant service on the pressure-tube "front."... Concentrating now, as always, on *Globe Quality* steel tubes, we faced no problem of "conversion" to meet the unprecedented demands of industry's war-production power plants...transport, merchant and warships...locomotives and other units of war power-equipment requiring super-quality and 24-hour-a-day operative ability in boiler tubes, condenser and heat-exchanger tubes, stainless and mechanical tubing.

GLOBE engineers offer their long experience and superior facilities to aid you in selecting steel tubes of proper characteristics for your specific needs.

★ STAINLESS TUBES
★ BOILER TUBES
★ GLOBEIRON TUBING
★ GLOWELD TUBES

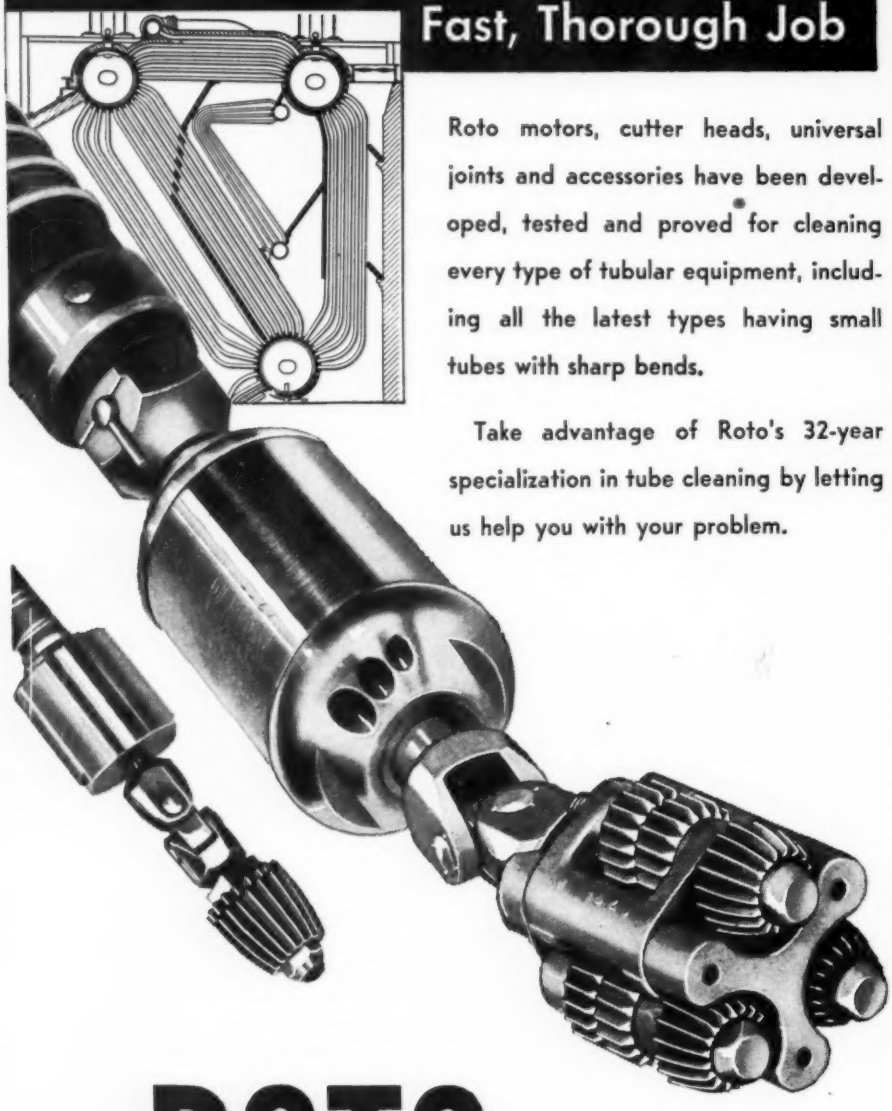
GLOBE TUBES

★ CONDENSER AND HEAT EXCHANGER TUBES
★ MECHANICAL TUBING

GLOBE STEEL Tubes

GLOBE STEEL TUBES CO., *Milwaukee, Wisconsin, U.S.A.*

Clean Tubes Give Greater Production for War..... Use ROTO for a Fast, Thorough Job



Roto motors, cutter heads, universal joints and accessories have been developed, tested and proved for cleaning every type of tubular equipment, including all the latest types having small tubes with sharp bends.

Take advantage of Roto's 32-year specialization in tube cleaning by letting us help you with your problem.

The ROTO Company
145 Sussex Ave., Newark, N. J.

Write for Working Sample
Send for 36 page catalog.

Put "AMBEST" to a long life test on any tough job

This UNIVERSAL packing—of long, pliable, anti-friction metallic alloy strands—assures low cost, long life packing protection and easy application on any rod in good condition. "AMBEST"—available for all pressures and temperatures up to 550° F.—is recommended for pumps, compressors, engines, throttles and valve stems. All needs are supplied by one packing when you use "AMBEST."

"EUREKA"

EUREKA PACKING CO., 294-296 46th St., BROOKLYN, N. Y.

type of boiler. In some states which have their own boiler regulations, it is forbidden to operate boilers of that type at 120 psi after they have passed the age of the boilers under discussion. The ASME code contains a similar regulation.

The only thing to do would be to appeal to the proper authority for an extension of life until new boilers could be secured with the understanding that, during the period of extended life, hydrostatic tests of prescribed pressure would be applied every 30 or 60 days or as often as required. It just seems futile to hope for an indefinite or permanent extension of service at the higher pressure.

Pittsburgh, Pa. C J WYROUGH

Service Depends On Boiler's Condition

I SEE NO REASON why the boilers operated by CJJ should be placed in the category of low-pressure units since they are nearing the end of their expected life. This assumption is based upon the remarks that the boiler is in excellent condition otherwise, and that they are of butt and double-strap construction and the allowable working pressure is computed with a reasonable factor of safety.

CJJ does not tell us what the boilers are used for but the operating pressure may be reduced materially without efficiency impairment in so far as fuel consumption is concerned.

Caustic embrittlement can be revealed only through laboratory tests, but such infected areas may be exposed either by the hammer test administered by an expert boiler inspector or by the disclosure of fine hairline cracks usually exhibited in close proximity of the longitudinal seam. If close scrutiny reveals no such defects I would not hesitate to approve of the boilers at a pressure computed on ASME construction. I speak as a licensed boiler inspector.

Richmond, Va. T J HAMMOND

Made Emergency Repairs

MUST THESE BOILERS be replaced?—this is a problem which will not be so easily solved, since many factors, such as physical condition and age of boilers, are entering the situation. Only last year, I was confronted with identical circumstances.

We could have had our boilers repaired to meet the insurance requirements but, owing to priorities no sheets were available and, besides, the re-

HERE IS THE CAST STEEL VALVE SITUATION

In this chart, the solid portions show the result of increased pressure by Army, Navy, Air Force, Lend-Lease and of industry essential to war.

SOLID SECTIONS REPRESENT THE DEMANDS OF WAR PRODUCTION

Two years ago, READING-PRATT & CADY had sufficient warning of this to advise you that: "Today it is more than good business to use valves . . . that put far into the future the day when their wearing out will call for the use of vital metals to replace them." And throughout 1942 we continued to offer practical suggestions to help keep your valves in service.

Ships, high octane gasoline, materials for synthetic rubber, handling and transfer of gasoline by Army and Navy, will absorb valve production for some time.

To say we wish this were not so is just another way to say we pray for early victory. You will back us up in our belief that the best way for us to help bring this day closer is to continue to do all we can to deliver to every agency of war the valves requisitioned of us.

In the meantime, continue to guard your valves by regular inspection. It will point the need for maintenance that will make them last longer, give more satisfactory service.

READING-PRATT & CADY

MANUFACTURERS OF
READING CAST STEEL VALVES AND FITTINGS • PRATT & CADY BRASS AND IRON VALVES
D'ESTE VALVE AND ENGINEERING SPECIALTIES

Reading, Pa., Atlanta, Boston, Chicago, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, San Francisco, Portland

A DIVISION OF ACCO **AMERICAN CHAIN & CABLE COMPANY, Inc., BRIDGEPORT, CONNECTICUT**

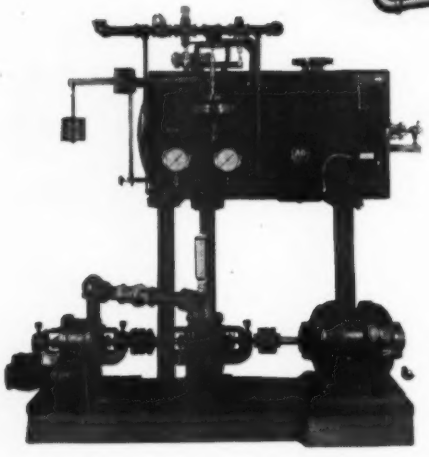
ACCELERATING PRODUCTION

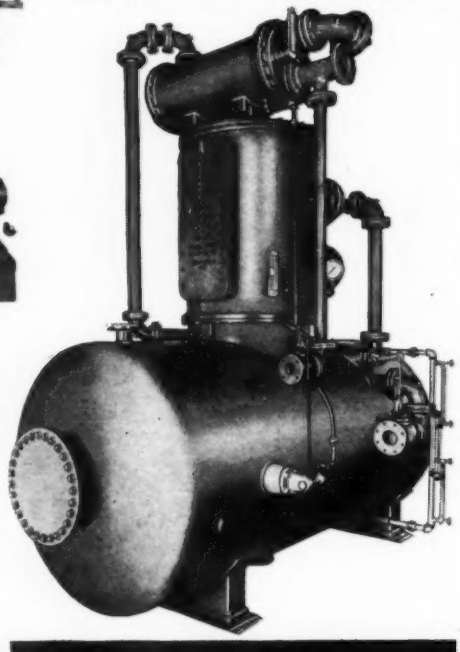
Saving Steam — Saving Fuel — In Industries and Institutions Where Steam Is Used for Processing or Heating • Increasing the Efficiency of Machines and Men

● Four series of Stickle Open Float Steam Traps, free of internal mechanism to wear out and cause trouble, supplying dependable operation and high capacities in ratio to size, in desired sizes and for high medium and low pressures, and for vacuum service. Indicate needs for special bulletin.

● Stickle Regulating and Reducing Valves, in single-seated and double seated series, from small to large sizes, built to meet requirements for exacting control. Balanced and Semi-balanced construction, in Lever Operated, Lever and Weight Loaded Diaphragm Operated, Spring Loaded Diaphragm Operated Types. Also Pilot-Operated Valves. Bulletins Nos. 235 and 435 give complete description and specifications.

● Stickle Differential Drainage and Boiler Return System—a closed pumping system—returns condensate to boilers at only 15 to 20 degrees under temperature of steam at operating pressures. Saves approximately 15 per cent boiler fuel consumption, increases boiler capacity a like amount and reduces maintenance. Ask for Bulletin No. 50.





● Stickle Open Coil Feed Water Heaters and Purifiers heat more water in less space. Deaerating and Non-Deaerating Types. Small to large sizes. Cast iron or steel shells. Described and illustrated in Bulletin No. 117.

ARMY E NAVY

STICKLE

STEAM SPECIALTIES COMPANY

2265 Valley Avenue • Indianapolis, Indiana

SPECIALIZING FOR 35 YEARS IN REDUCING THE COST OF STEAM

pairs would have cost one and one-half times the amount of a new boiler. After seven months, and with the kind cooperation of the state and insurance inspectors, we received permission to proceed with an emergency repair for the duration only (reinforcing sides and rear with additional staybolts) at a total cost of approximately $350.00 per boiler.

If the boilers are in as good a condition as CJJ assumes, the state inspector will be of assistance to inspect (drilling, sounding, hydrostatic test) the boilers thoroughly and to advise him accordingly.

CARL BACHMANN

Schenectady, N. Y.

Thanks, Anyway

DJM's question produced a landslide of answers and it was impossible to publish all of them. The editors therefore wish to acknowledge answers received from the following engineers: H D Brown, Lombard, Ill.; C D Price, Baltimore, Md.; S Marano, Philadelphia, Pa.; A J Wenig, Brooklyn, N. Y.; E J Oppenheim, Harrisburg, Pa.; A B Duryee, New Rochelle, N. Y.; G E Beeman, Akron, N. Y.; A W Brown, Union City, Ind.; J Rast, Roselle Park, N. J.; F Raphaelian, Neptune, N. J.; E D Carl, Binghamton, N. Y.; A Greer, Bronx, N. Y.; F Meyer, Bogota, N. J.; G Holman, Marissa, Ill.; T F Cunningham, Philadelphia, Pa.; C O Sandstrom, Los Angeles, Calif.; J A Byron, Vancouver, B. C.; W T Mullen, Philadelphia, Pa.; C T Geiger, San Diego, Calif.; N H Brickham, Cheyenne, Wyo.; A H Parker, Petersburgh, N. H.; E Mills, Wilmington, Calif., and R C Baker, Clearwater, S. C.

Questions & Answers

(*Continued from page* 116)

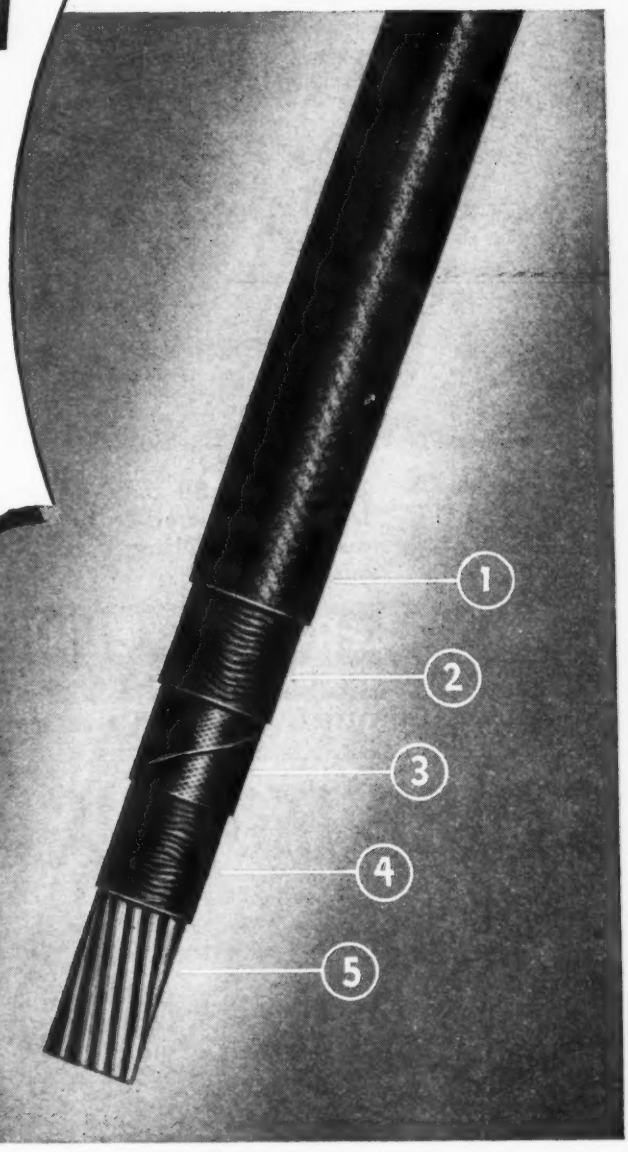
nace volume makes operation at ratings in excess of about 125% impracticable. (g) tube maintenance, except with the submerged-head boiler, may be high.

Q 24—Describe the horizontal-return-tubular (hrt) boiler.

A—This boiler, Fig. 5, is probably the most common form of externally fired firetube boiler and the most widely used boiler in small or medium-sized power plants. Unlike the vertical, tubular, locomotive or dry-back marine boil-

ROCKBESTOS A.V.C.

Withstands HEAT and VIBRATION



ROCKBESTOS PERMANENT INSULATION INSURES LONG-LIVED PERFORMANCE

Rockbestos A. V. C. Power Cable above and similarly insulated Motor Lead Cable (Underwriters' and Nat. Elec. Code, Type AVA) has a maximum operating temperature rating of 110° C. (230° F.) and this permanently insulated construction.

1. A tough, rugged asbestos braid, resistant to heat, flame, moisture, oil, grease and corrosive fumes.

2. Outer felted asbestos wall which serves as a heat-barrier against high ambient temperatures.

3. Lubricated varnished cambric for high dielectric strength and added moisture resistance, protected from heat and flame by two felted asbestos walls.

4. Felted asbestos insulation that withstands conductor-heating overloads and won't burn even when exposed to copper-melting arcs.

5. The conductor is perfectly and permanently centered in helically applied insulation.

One of 122 different wires and cables developed for severe operating conditions.

RESISTS moisture, oil, grease and fumes. WON'T bake brittle, burn, flow or rot.

In electrical circuits that run around hot strip mills, soaking pits, furnaces, boilers, lehrs, kilns, forging presses—wherever heat and vibration causes wire failure too often—you'll find Rockbestos A. V. C. living up to its reputation of providing trouble-free, dependable performance under the toughest conditions.

Designed especially for high temperature applications, *permanently insulated* Rockbestos A. V. C. won't crack, bake brittle, bloom, rot or swell. It resists heat, flame, moisture, grease, oil and corrosive fumes.

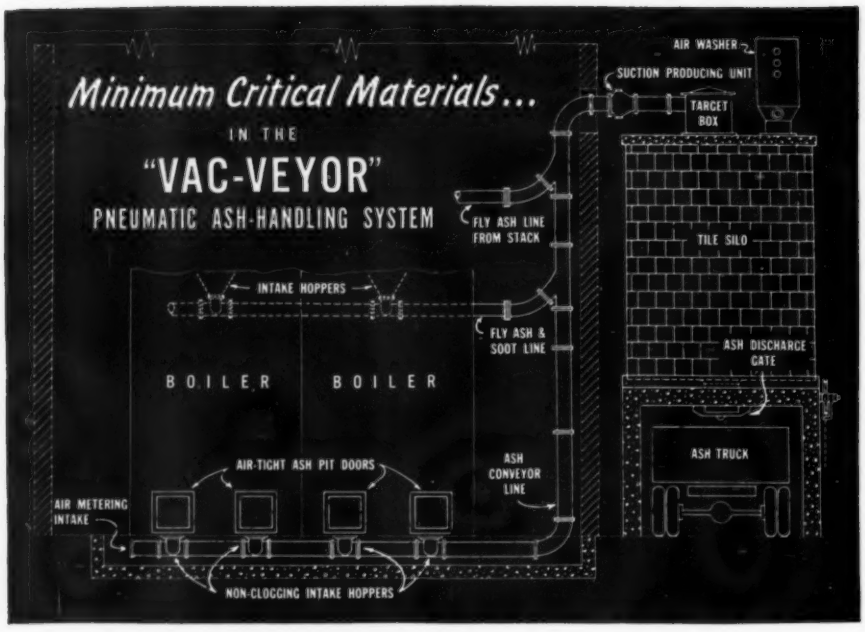
Avoid serious production delays caused by wire failures, use Rockbestos A. V. C. wire, cable and cord in "hot-spot" circuits.

When inquiring or ordering, please furnish CMP certification and allotment number with delivery month number. For full particulars, write nearest branch office or: Rockbestos Products Corporation, 899 Nicoll Street, New Haven, Connecticut.

ROCKBESTOS A.V.C. ***The Wire with Permanent Insulation***

NEW YORK, BUFFALO, CLEVELAND, CHICAGO, PITTSBURGH, ST. LOUIS, LOS ANGELES, SAN FRANCISCO, SEATTLE, PORTLAND, ORE.

FOR VICTORY—INVEST IN U. S. WAR BONDS



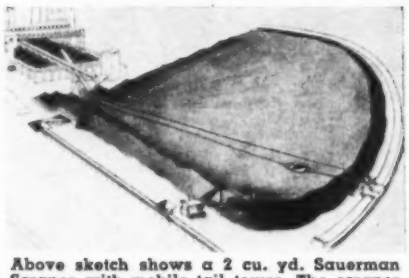
Write us today for complete details

Designed to fill today's needs in either new installations or oil-coal conversion, this pneumatic ash handling system offers numerous advantages.

BEAUMONT BIRCH COMPANY
1505 RACE STREET PHILADELPHIA, PA.

MANUFACTURERS AND ERECTORS OF COMPLETE COAL AND ASH HANDLING SYSTEMS

STORE MORE COAL - - -



Above sketch shows a 2 cu. yd. Sauerman Scraper with mobile tail tower. The scraper handles 100 tons per hour and has piled 50,000 tons on a quarter circle area within its 350 ft. radius.

Here is a Sauerman unit using a tail bridle instead of a tail tower. This ¾ cu. yd. scraper handles up to 450 tons per day; piles 8,000 tons on small space.

the safe, economical SAUERMAN way

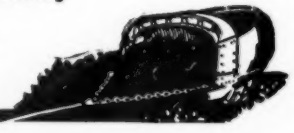
Increased fuel storage is one of the "musts" in the war production program. Plants that once were satisfied to carry a month's supply of coal now look upon four to six months' supply as a minimum.

You can increase your present coal storage capacity economically, regardless of the shape or size of the available ground area, with a Sauerman Power Drag Scraper.

This machine is able to pile a larger tonnage safely on a given space because it stacks the coal layer upon layer to form a homogeneous pile that avoids segregation. Such a pile is practically safe from any danger of spontaneous combustion.

Write today for useful catalog

SAUERMAN BROS., Inc.
562 S. Clinton St., CHICAGO



ers, the hrt contains no firebox and must be externally fired. This makes a brick setting necessary; it may support the boiler if not over 72 in. diameter. Some boilers up to this size use steel columns and hangers, which are required for larger sizes. The boiler itself is a cylindrical shell with flat ends or heads and contains a large number of fire tubes.

The grates are beneath the front part of the boiler shell. The hot gas from the furnace passes along the bottom of the shell to the rear, returning through the firetubes to the smoke box at the front and thence to the stack. This *return* tube arrangement gives the hot gas a much longer travel than it has in the *direct* tube arrangement of the vertical, tubular or locomotive boilers, where gas passes directly from the fire through the tubes to the chimney.

Q 25—What are the advantages and disadvantages of the hrt boiler?

A—It is simple in construction, has a fairly low first cost and is a good steamer. It is more economical than the vertical tubular or locomotive types and hence more suitable for medium-sized stationary plants. On the other hand, it is difficult to remove hard deposits of scale from the surfaces of the inner rows of tubes, and there is great danger of burning the shell plates above the fire if thick scale or deposits of mud form on these plates. This difficulty in cleaning scale from the tubes is also encountered in the other types of firetube boilers. The proportionately small area of heating surface exposed to radiant heat limits the efficiency and flexibility of heat absorption.

Q 26—Why isn't the hrt boiler built in larger sizes?

A—Hrt boilers are rarely if ever built larger than 96 in. in diameter or for pressures higher than 175 psi because of the thick shell plates required. Thick plates exposed directly to intense heat deteriorate very rapidly from overheating.

Engineers Books

(*Continued from page* 124)

National Electrical Code. The definitions are of terms most commonly used by practical electrical workmen and are presented in easily-understood language. Because of its practical treatment the book is well adapted to home study work and by vocational schools.

Perhaps REVERE can help you with your NON-FERROUS

- Heat Exchanger tubes and shells
- Intercoolers
- Receivers
- Strainers
- Evaporators
- Water treating equipment

Revere is trying in every way to help iron out kinks in war production problems for old and new users of copper and copper alloys. In addition to supplying condenser and heat exchanger tubes and tube plates, Revere may be able to give first aid to you in one or more of four ways:

1 Revere copper and copper-base alloys... sound, superior metals produced in a range of compositions and forms meeting the special requirements of war processes.

2 Revere Bimetal... where war requirements and service conditions demand, Revere can supply bonded Bimetal sheets and plate of S.A.E. 1010 carbon steel clad on one or both sides with copper as well as with certain other metals and alloys.

3 Welding technique... *practical* assistance in welding these products, which will aid in the completion of equipment *when* needed and insure uninterrupted service.

4 Revere Engineering Service... to help Revere customers in the selection of metals and in methods of fabrication so as to save time, increase output and reduce costs wherever possible.

If you have special problems, send us specifications and full details of your requirements. We will endeavor to supply an answer promptly. Get in touch with Revere today.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

Executive Offices: 230 Park Avenue, New York

Sales Offices and Distributors in Most of America's Major Cities

ADECO NOZZLE TESTER
For Economical Maintenance

America's most widely used Nozzle Tester enables any mechanic to make quick, accurate tests on injector opening pressure, spray pattern, etc., and detect stuck needle valves and leakage around valve seats. Compact, portable, sturdy, precision-built. Pressures up to 10,000 p.s.i. Tests both large and small injectors. Avoids costly delays and possible damage to engine. Best for economical maintenance. Write for new illustrated bulletin.

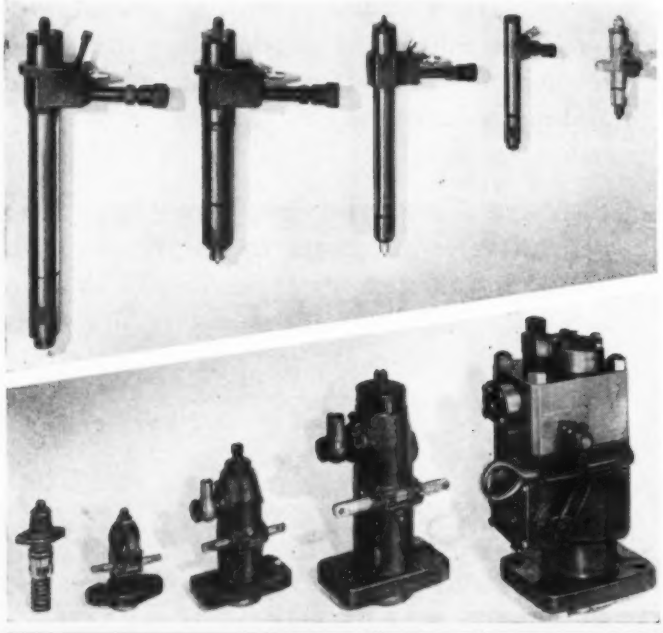
ADECO "KNOW-HOW"

BRINGS YOU THE FINEST IN DIESEL FUEL INJECTION EQUIPMENT

Back of every Adeco product is a thorough knowledge of diesel requirements, gained through years of experience in serving the diesel industry. This understanding combined with Adeco's wide research and manufacturing facilities provides a most dependable source for the finest in diesel fuel injection pumps, nozzles and nozzle holders.

ADECO

Write for complete Adeco Catalog



AIRCRAFT & DIESEL EQUIPMENT CORPORATION
4401 NORTH RAVENSWOOD AVENUE • CHICAGO, ILLINOIS

ECONOMY LOADING OF POWER PLANTS AND ELECTRIC SYSTEMS. *By M J Steinberg and T H Smith, Consolidated Edison Co of New York. Published by John Wiley & Sons, New York, N. Y., 203 pages, 6 x 9 in., illustrated, cloth binding. Price $3.50.*

Making the incremental rate theory of power plant loading available in compact simplified form to load dispatchers, system operators and station operating personnel as well as planning engineers faced with evaluation of alternate proposals is the function of this book. Economy loading of individual units faces every operator of two or more power-generating units.

Theoretical background is covered in the first chapter for clear understanding of the fundamentals. Typical input-output curves are shown and the theory reinforced by consideration of practical problems. Load division among boilers, turbines and stations are worked out in detail as to method and practical application.

PRINCIPLES OF ELECTRONICS (First Edition—1942). *By Royce Gerald Kloefler, Professor of Electrical Engineering, Kansas State College. Published by John Wiley & Sons, 440 4th Ave, New York, N. Y. 175 pages, 6 x 9 in. illustrated, cloth binding. Price, $2.50.*

A working knowledge of generators, motors, electromagnets and circuits is no longer sufficient for the power engineer. A vast new electrical science, electronics, has been developed within recent years that demands the attention of all electrical workers. Electron tubes now perform in power and industrial plants hundreds of operations formerly done by other means and many others can be done only by these tubes. During the war a vast store of electronic knowledge is being accumulated that will be turned to industrial pursuits when peace returns. So it behooves plant engineers and electricians to equip themselves with a good working knowledge of electronic devices and other circuits. In this book will be found much of the information to do this job. Its fourteen chapter headings are: Introduction, the electron, the atom, electricity, gaseous conduction, electron emission, 2-electrode tubes, 3-electrode tubes, multi-electrode tubes, special tubes, rectifying tubes, some physical theories, photoelectric devices, and electronic applications and circuits. Most books on electronics are highly mathematical, whereas this one is practically void of such treatment. It gives

How to make your old Valves "Good as New" —Quickly . . . Easily . . . at Low Cost

USE

DEXTER

VALVE RESEATING EQUIPMENT

When a valve *starts* to leak . . . you can fix it right away — on the line — with Dexter Valve Reseating Equipment. No delays, no production upsets.

Even when a valve has been allowed to reach a "junked" condition, it can often be brought back to life with Dexter Valve Reseating Equipment . . . made to give "good as new" performance again. And it doesn't take long to make a valve seat and disc or gate *absolutely tight* again.

Dexter Equipment is equally efficient with *all* makes and types of valves because there are Dexter Cutters for monel, stainless steel, stellite, bronze and brass. Send for further information about Dexter Equipment today.

DEXTER

Valve Reseating Equipment

THE LEAVITT MACHINE COMPANY

106 EAST RIVER STREET, EAST ORANGE, MASS.

CAPACITIES: *Globe valves, ¾" to 14"; Gate valves, 1½" to 48"; Pump valves, 1½" to 15".*

clear practical explanations of the construction and operation of the different types of electron tubes, their circuits and applications, therefore fills a long-felt need by practical electrical engineers and electricians.

Radiology

INDUSTRIAL RADIOLOGY (Second Edition, 1943)—*By Ancel St John and Herbert R Isenburger. Published by John Wiley & Sons, New York, N. Y., 298 pages, 6 x 9 in., illustrated, cloth binding. Price $4.00.*

Use of radium and x-ray methods for inspection of materials has changed greatly in the nine years that have passed since the first publication of this basic description of equipment and procedure. The second edition has been expanded to include visual examination of materials with the fluoroscope as well as by photographic plate.

The authors discuss the nature and properties of x-rays, x-ray generators, procedure for making a radiograph, interpretation of radiographs, radiography of castings and forgings, welded structures, specifications and inspection. Appended in convenient form are rules, tables and charts.

Heat Engines

THEORY AND PRACTICE OF HEAT ENGINES. *By R H Grundy. Published by Longmans, Green and Co, 55 Fifth Ave, New York, N. Y. 720 pages, 6 x 9 in., illustrated. Price $6.25.*

A British approach to the power engineers education starting with fundamental physics and thermodynamics and proceeding in logical steps to large engines and turbines. Enough theory is presented to explain each practical illustration, both sides of the idea being closely associated as an aid to self-instruction.

Typical of 13 chapters on fundamentals is one explaining the action of steam in the reciprocating steam engine cylinder. Nine chapters deal directly with boilers, engines, turbines and accessories.

Standards

1942 BOOK OF ASTM STANDARDS. *Published by the American Society for Testing Materials, 260 South Broad St, Philadelphia, Pa. In three volumes. Price, $9 per volume.*

Specifications, definitions and methods of test are issued every three years with annual supplements. Present issue contains extensive amplifications

Old? Yes...

and Work-Wise!

Elderly Ludlow Valves—like a work-wise veteran who has long followed his trade—are proving their worth in these days of equipment shortages. Engineers find that even grandfather-aged Ludlows have a surprising amount of active service left in their still sturdy bodies. Checked-up at the repair clinic and re-outfitted, they're going back on the job—for duration!

Now that you think of it—hasn't this more-than-average service always been a Ludlow characteristic? For these extended-service valves, Ludlow will aid in supplying the same enduring replacement parts. Check up on your priority and send in your order.

THE LUDLOW VALVE MFG. CO., INC.
TROY, NEW YORK

Construction Features: Self-releasing 30° angle wedges and free-floating gates, self-adjusting to seats, afford smooth, trouble-free performance, long service. Rings are cleaned throughout stroke action. Gates are wedge-locked directly opposite ports and completely unwedged before raising. Ample tolerances provide easy action. Simple construction permits easy replacement of parts.

LUDLOW VALVES
SINCE 1866

YOU CAN DECREASE REFRACTORY LINING SHUTDOWNS WITH BRICKSEAL

CORRECTIVE - PROTECTIVE
HIGHLY GLAZED
MONOLITHIC COATING

- Brickseal, a semi-plastic coating, prevents brick refractory linings from developing minute cracks or fissures in the brick or joints when forced to undergo rapid changes of temperature.
- Brickseal can be sprayed or brushed on easily. Once on, it will not crack, peel, bloat or blister and . . . it is impervious to acids, alkalis, and all combustion gases.
- **SEE A BRICKSEAL SAMPLE** . . . and find out how Brickseal makes a wall last longer . . . how it cuts down maintenance. Write or telephone today for a Brickseal representative. No obligation.

BRICKSEAL
REFRACTORY CO.
1029 CLINTON ST.
HOBOKEN, N. J.

The Ideal "TOP KICK"

Many an industrial commander, in these critical times, notes with keen satisfaction the smooth, well drilled performance of his steam power plant—and gives deserved credit to his "top sergeant": A Hays Combustion Control System.

Here, indeed is a seasoned, capable veteran, skilled at getting utmost efficiency out of the equipment he commands.

Automatically, "The All-Electric Way" Hays system controls combustion. It's made to do that. It regulates all combustion elements—measures each variation and corrects instantly—measures the correction: *maintains the right balance.*

With the nation's war effort putting extra demands on present steam power equipment, Hays Combustion Control Systems are doing an extraordinary job—stretching steam capacity, *safely;* getting the utmost out of existing boiler room equipment, *safely;* saving man-hours, saving operating costs.

To enlist this veteran in your own service, send for the Hays Combustion Control Catalog—it is full of pertinent steam-power data.

THE MODERN SYSTEM *It's Electrical*

HAYS *Automatic* COMBUSTION CONTROL

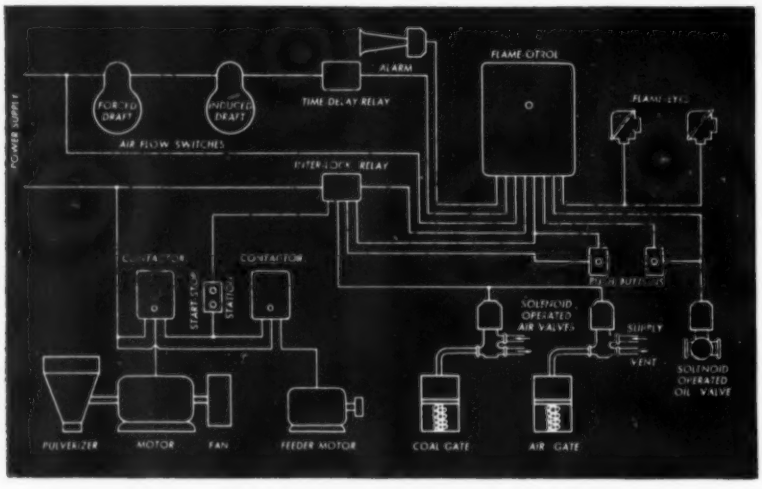
THE HAYS CORPORATION • MICHIGAN CITY, IND.

COMBUSTION SAFEGUARD

Approved by both

UNDERWRITERS' LABORATORIES and ASSOCIATED FACTORY MUTUAL LABORATORIES

for ALL TYPES OF FUEL



Combination pulverized coal and oil burner protected by Wheelco Flame-otrol with complete purging cycle and safety shut-off features.

The Wheelco Flame-otrol is the only combustion safeguard approved by both the Underwriters' Laboratories and Associated Factory Mutual Laboratories for all types of fuel. Fuel to the burner is shut off instantly upon flame failure, or should any condition develop within the instrument itself, which might interfere with its operation, thereby preventing fuel and fume accumulation in the combustion chamber—the source of explosion hazard. The Flame-otrol is available with automatic or manual ignition, time delay for purging, or any other sequence of operation desired.

Bulletin L-2 gives complete information on Wheelco Flame-otrol. Request your copy TODAY!

Wheelco Instruments Co.

863 W. HARRISON STREET • • • CHICAGO, ILLINOIS

Originator of "Electronic Principle" Temperature Controls

and revisions of basic standards brought up to date by competent, unbiased authorities and are accompanied by loose-leaf emergency alternate provisions for many materials affected by wartime requirements.

Standards are based on best commercial practice, formulated and recommended by standing committees of well informed technologists, and are intended to furnish a common meeting ground for purchaser and seller as to quality of engineering materials.

Volume I covers ferrous and nonferrous metals, 1730 pages. Volume II on non-metallic materials deals with masonry, ceramics, timber, paints, road materials, waterproofing and insulating materials, 1520 pages. Volume III, also non-metallic materials, quotes standards for fuels, petroleum products, electrical insulating materials, rubber, textiles, soaps, paper, plastics and includes general testing methods.

A separate volume on chemical analysis of metals is available (price $3), the only place where these methods are published.

Brief Reviews

DIVIDENDS FROM YOUR POWER PLANT. (1943) *Published by Preferred Utilities Co, Inc, 33 W 60 St, New York, N. Y. 48 pages, paper bound, available on request.* The booklet is written for executives in the language of executives, so that managers without extensive engineering training can understand the principles governing the economical operation of steam generating equipment. The booklet discusses subjects such as: the dollars and cents importance of boiler efficiency; the relation between steam costs and profits; natural vs mechanical draft; carbon dioxide and carbon monoxide; excess air, and factors that govern labor costs in the boiler room. The text is pointed up with examples, tables and sketches to make each topic clear.

MECHANICAL WORLD YEAR BOOK. (1943) *Published by Emmett & Co, Ltd, 78, Palatine Road, Manchester, England.* Latest edition of this British book presents a new section on light metals and alloys that play an important part in modern warfare. Information on die castings and plastics is also presented, and the editors state the remainder of the volume has been revised and recent data are included in the table of speeds and feeds on certain types of cutting tools.

MORE POWER FOR TANKS TODAY—
CHEAPER POWER FOR AMERICA TOMORROW!

AMERICA'S tanks pack a powerful push as well as a powerful punch. And more times than most people know, this push comes from a General Motors Diesel engine.

What's more, you'll also find these rugged, hard-working power plants in landing barges, patrol vessels, military trucks, construction tractors and many other wartime jobs where sturdy dependability is required.

They burn cheaper fuel and use less of it—operate with a minimum of attention.

Of course the needs of war are taking every engine that even our expanded production can make, but when peace comes America will profit —through low-cost power for many new applications.

So while now GM Diesels are adding strength to America's fighting arm, they will be one of the important contributions to better days after victory is ours.

New eras of railroading follow in the footsteps of war. Another new era of railroading is assured in the wake of this war. General Motors Diesel locomotives already are establishing new standards of transportation.

GM
GENERAL MOTORS
DIESEL POWER

ENGINES.....15 to 250 H.P.....DETROIT DIESEL ENGINE DIVISION, Detroit, Mich.

ENGINES..150 to 2000 H.P...CLEVELAND DIESEL ENGINE DIVISION, Cleveland, Ohio

LOCOMOTIVES.....ELECTRO-MOTIVE DIVISION, La Grange, Ill.

Runs at Turbine Speeds

The De Laval-IMO Oil Pump has only 3 moving parts, which are in perfect rotational balance, and no gears, valves or separate bearings. It can be coupled directly to standard speed motors and turbines to deliver any grade of oil in any volume against any pressure. The turbine-driven lube oil pump here shown is one of five in service on the World's largest ore carriers.

Ask for Publication I-107.

IMO PUMP DIVISION
of the De Laval Steam Turbine Company
Trenton, New Jersey

PLASTIC PATCH

Takes Traffic Immediately . . .

No traffic interruptions when you patch broken concrete with durable INSTANT-USE. Material comes ready mixed. Simply shovel into hole, tamp and run traffic over immediately—without waiting. Bonds tight to old concrete. Makes smooth, solid lasting patch. Withstands extreme loads. Keep a drum on hand for emergencies. Immediate shipment.

REQUEST DESCRIPTIVE FOLDER

. . . and Details of **FREE TRIAL OFFER**

INSTANT-USE
FLEXROCK CO., 2377 Manning St., Phila., Pa.

New Equipment

(*Continued from page* 126)

portionate flow of chemicals for boiler feedwater treatment, etc. Timers are available for seven different time ranges from 30 sec to 60 min total cycle. Inclosed in dust-tight molded Bakelite case for flush mounting 3¼-in. diameter, and 3$\frac{3}{32}$-in. overall length. Also can be furnished with various types of surface mounting steel connection boxes. *R W Cramer Co, Inc, Centerbrook, Conn.*

Glass Thermometers

PRESSED-STEEL CASE GLASS THERMOMETER incorporates all major design improvements accumulated over the years. It has been made so that it is possible to furnish back, side and oblique angles without using ball joint. Scales and tubes are located in manner which produces greatest readability, new method of making scale has been developed which produces a more legibile and better-looking scale than has ever been available before. Case has been reinforced to give all structural stiffness of a plate girder. Case is practically corrosion-proof. Scale is black with yellow figures; tube is ready-reading mercury. Meets fully Navy specification 18-T-7. *American Schaeffer & Budenberg Instrument Div, Manning, Maxwell & Moore, Inc, Bridgeport, Conn.*

Test Kit

PORTABLE TEST KIT, for relay and electrical operation of 125-216-volt secondary network protectors, is designed for routine testing in field. Variable currents and variable voltage for relay testing and mechanism operation are obtained by means of fixed resistors, a transformer, and a variable autotransformer designed for smooth, continuous control of voltage. All equipment is contained in plywood and fibre portable case measuring 15x11x26 in. and weighing 92 lb. *Westinghouse Electric & Mfg Co, East Pittsburgh, Pa.*

Midget Proportioning Pump

MIDGET ADJUST-O-FEEDERS are available in either plunger or diaphragm type; plunger units range in capacities from 0 to 10 gph. Plunger type are equipped with Proportioneers' fluid steel stuffing gland for hard-to-handle and corrosive fluids. Diaphragm types are built in capacities ranging from 0 to 7½ gph, and for pressures from 0 to 100 psi.

ONE LESS "CHORE"

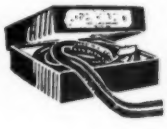
to worry about when you use G-T PACKINGS

. . . because PALMETTO and all of the other G-T Packings stay soft . . . last longer . . . reduce the frequency of repacking.

G-T Packings assure these results because of their ***internal*** lubrication. These packings are not merely dipped in lubricant after braiding. Their exclusive manufacturing process thoroughly saturates each individual strand with a special lubricant ***before*** the strands are braided, plaited or twisted. Moreover, each of the different G-T Packings (see list below) has a special lubricant . . . developed for its particular service . . . and compounded in our own plant.

These are some of the reasons why G-T Packings assure smallest yearly packing cost . . . and why it will pay you to try them.

WRITE FOR LITERATURE



BRAIDED
For rods and shafts; layer over layer construction insures uniformly even bearing surfaces.

TWISTED
For valve stems, each strand a perfect piece of lubricated packing.

GREENE, TWEED & COMPANY
Bronx Blvd. at 238th St., New York, N. Y.

PALMETTO
for steam, hot water, air. PALCO for water. PELRO for oils. CUTNO for alkalis. SUPERCUTNO (blue asbestos) for acids. KLERO for foods.
SELF-LUBRICATING
PACKINGS

COTTRELL PROCESS

of

ELECTRICAL PRECIPITATION

universally recognized as a
standard method of removing

DUST, FLY ASH, FUME, MIST & FOG

***from* GASES**

•

30 years of research development and operating experience throughout the world is incorporated in the

COTTRELL INSTALLATIONS

offered to meet the requirements
of any problem by

RESEARCH CORPORATION

405 LEXINGTON AVENUE
NEW YORK CITY

59 EAST VAN BUREN STREET
CHICAGO, ILL.

Put Your Old Darts BACK INTO HARNESS...

they still can give Tight-Joint Performance

Dart Unions are "work-horses" . . . they can be used over and over again. Even Darts that have served long and faithfully enough to be "retired to pasture" can still be counted on to give "tight-joint" performance.

Look at the illustration. It shows the two famous Dart extra-wide bronze seats, ground to "true-ball accuracy" . . . one reason for a Dart's long life and unusual performance. Another important reason is the fact that Dart bodies and nuts are made of air-refined malleable iron that resists pipe strains, rust and rough handling.

For the sake of metal conservation and the war effort, keep searching for used Dart Unions . . . and put them "back into harness." If you *need* new Darts, see your supplier today.

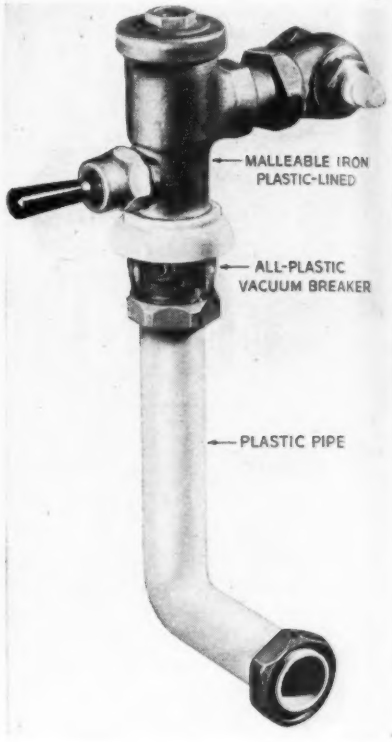
DART UNIONS

E. M. DART MANUFACTURING CO., PROVIDENCE, R. I.

Diaphragms are preformed Neoprene, and no stuffing gland or fluid seal is required. *Proportioneers, Inc, Providence, R. I.*

Flush Valve

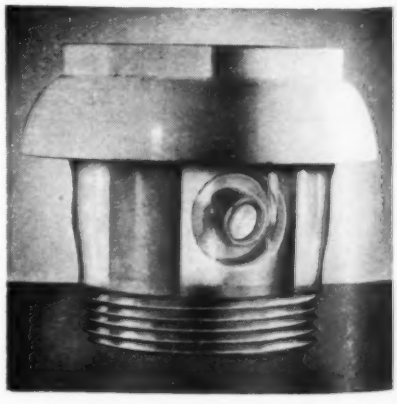
"VICTORY" TYPE FLUSH VALVE has been redesigned so that its net copper content has been reduced from approximately 6 lb to less than 4 oz per valve.

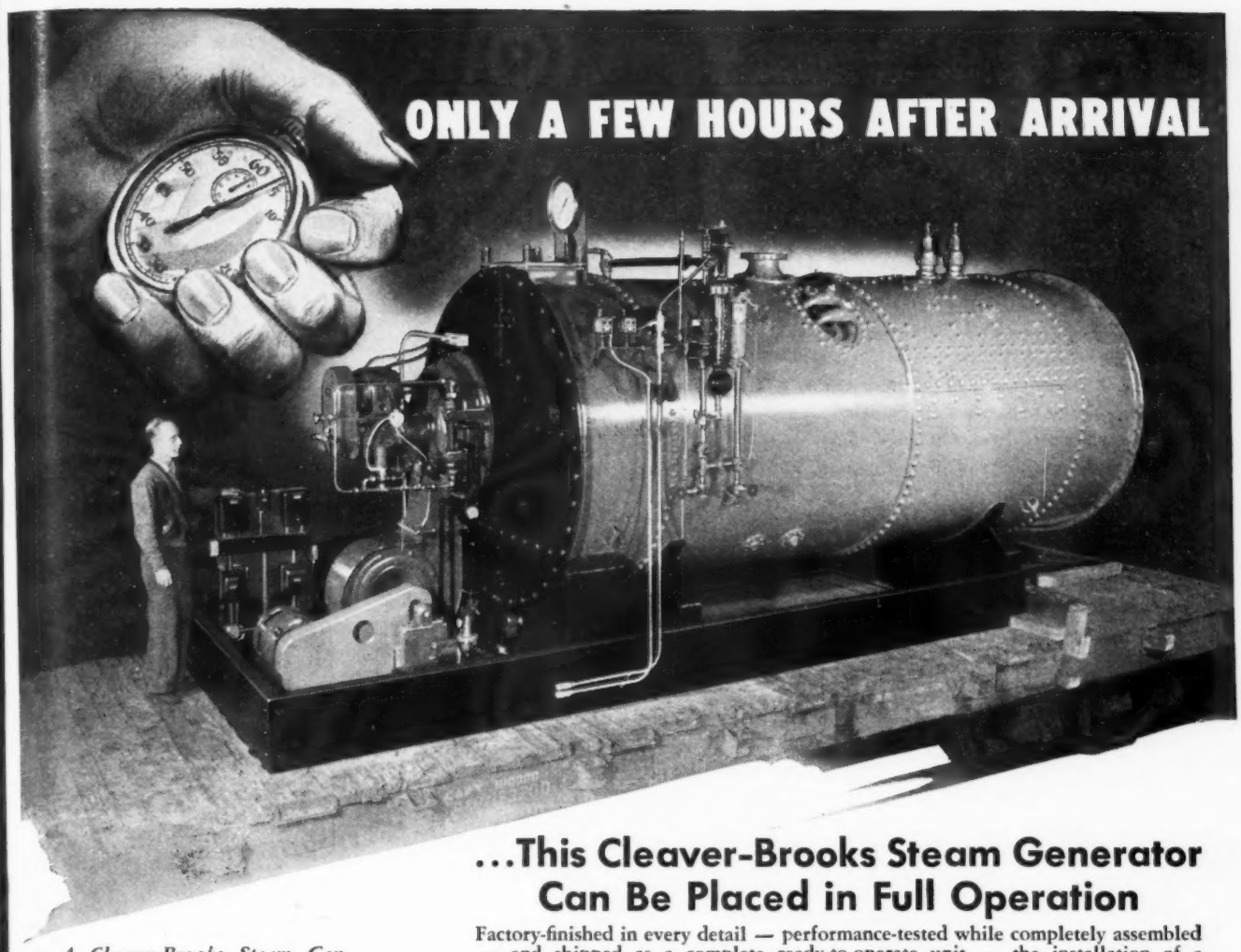


Body is now made of malleable iron with plastic sleeve inserted as lining. Piston has been simplified and is now made of plastic. *Sloan Valve Co, Chicago, Ill.*

Vacuum Breaker

SLOAN VACUUM BREAKER has been adapted to limits of plastic injection-molding in order to evolve an all-plastic vacuum breaker. Its unique features include transparent outer shell, permitting visual inspection of flapper and its operation. *Sloan Valve Co, Chicago, Ill.*





A Cleaver-Brooks Steam Generator Just Out of Factory Test-Pit—Ready for Shipment When Blocked and Trim Removed.

...This Cleaver-Brooks Steam Generator Can Be Placed in Full Operation

Factory-finished in every detail — performance-tested while completely assembled — and shipped as a complete ready-to-operate unit — the installation of a Cleaver-Brooks steam generator is only a matter of hours, rather than weeks of time. A job that is usually costly in time and money is reduced to a few simple piping and electrical connections.

These modern oil-fired steam generators are the answer to the demand of American industry and the military services for a steam plant with these advantages:

—greatest fuel economy — 80% efficiency guaranteed.

—quick steaming—for any emergency or fluctuating loads.

—clean — no smoke, ashes, soot or clinkers.

—compact "packaged" construction saves space.

—positive blower air supply eliminates high, costly stack; only a simple, short vent is required.

—four-pass down-draft construction gets all possible heat from fuel.

—one source and one responsibility for the complete unit — Cleaver-Brooks.

Whatever your present or future need for steam — within the range of a single installation (20 to 500 HP. — pressures 15 to 200 lbs.) or that of a battery of Cleaver-Brooks Steam Generators, secure full information now in anticipation of the time when normal conditions return.

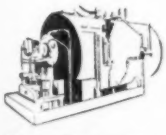
CLEAVER-BROOKS COMPANY, 5109 N. 33rd St., Milwaukee, U.S.A.

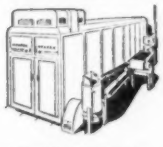
WHY INSTALLATION TIME IS CUT!

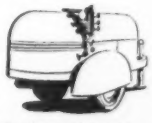
- ✓ *No Stack*
- ✓ *No Brickwork*
- ✓ *No Special Foundations*
- ✓ *No Breeching*
- ✓ *No Multiple Sources of Supply*

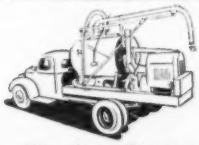
Cleaver-Brooks
STEAM GENERATORS

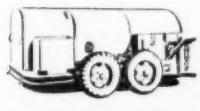
CLEAVER-BROOKS PRODUCTS INCLUDE:


Steam Generators


Food Dehydrators


Tank Car Heaters


Bituminous Boosters


Special Military Equipment

Low Cost . . . High Efficiency . . .

LUBRICATING OIL COOLER:

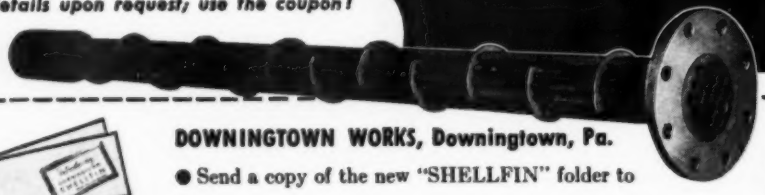
SHELLFIN*

the STANDARDIZED shell & finned tube HEAT EXCHANGER

*Pat. applied for

Finned tube construction gives very high efficiency ★ Very compact—much smaller shell diameter ★ High heat transfer rates at low pressure loss ★ Unusually low cost—because of quantity produced standardized design ★ Faster to obtain than specially designed units because of standard construction and quickly available engineering data.

All details upon request; use the coupon!



DOWNINGTOWN WORKS, Downingtown, Pa.

● Send a copy of the new "SHELLFIN" folder to

NAME_____

TITLE_____

COMPANY_____

ADDRESS_____

P-6

TOO TOUGH A NUT FOR VIBRATION TO HANDLE

UNSHAKO SELF-LOCKING NUT

Reg. U. S. Pat. Off.

That locking ring—with its brake band principle—positively prevents vibration from unwinding the "Unshako". YET—it can be backed off with a wrench and used again and again.

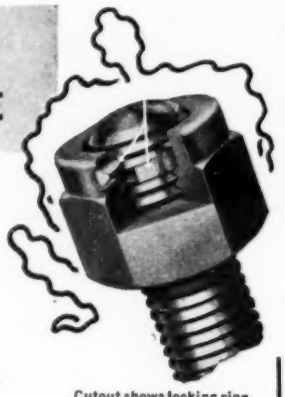
Write for Catalog!

STANDARD PRESSED STEEL CO.

JENKINTOWN, PENNA. BOX 577

— Branches —

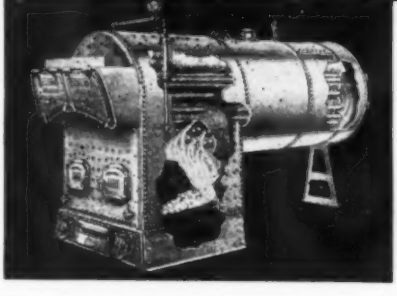
Boston • Detroit • Indianapolis • Chicago • St. Louis • San Francisco



Cutout shows locking ring. Pat'd. and Pat's Pending.

KEWANEE FIRE BOX BOILERS

Extra Strength . . . for Heavy Duty



Steel plus rivets supplemented by extra stout stays and braces in the boiler shell add extra years of service.

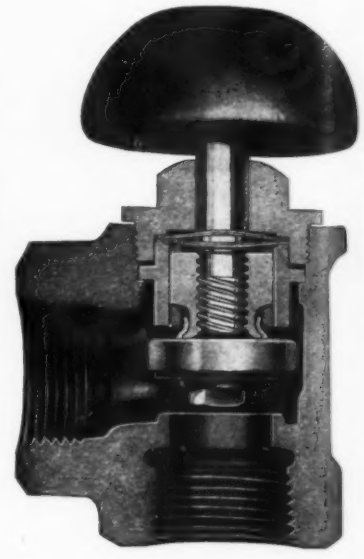
For 6" scale with pipe diameter markings, write Dept. 96-K-VI

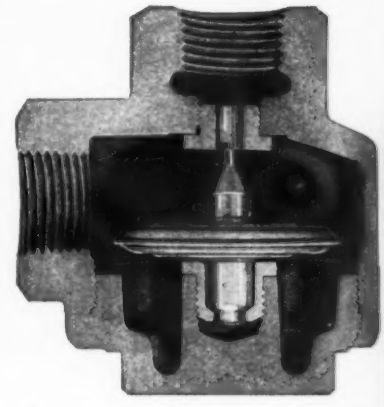
KEWANEE BOILER CORPORATION Kewanee, Illinois

Division of AMERICAN Radiator and "Standard" Sanitary Corporation

Steam Trap and Packless Radiator Valve

PRODUCTS SUPERSEDE CAST-BRASS BODY traps and valves. Thermostatic steam trap conforms to simplification program of WPB with cast-iron bodies and covers using minimum of critical materials. All sizes furnished in angle pattern



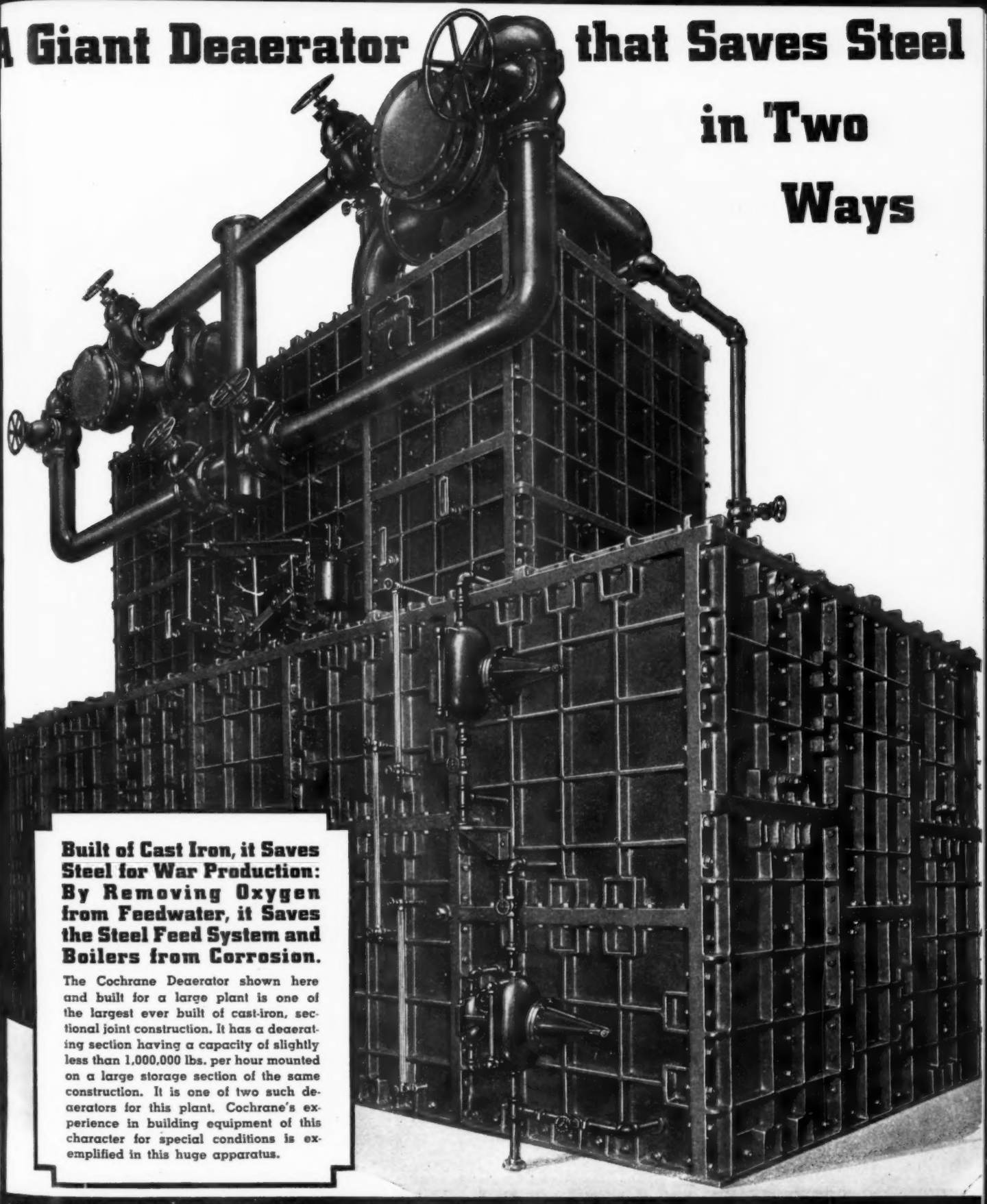


only. "Victory" radiator valve also conforms to simplification program of WPB, with cast-iron bodies and covers using minimum of critical materials. Also furnished in angle pattern. Trap is made in three sizes, ½ in. for 200 sq ft; ¾ in. for 400 sq ft; ¾ in. for 700 sq ft. Valve is made in two sizes, ¾ in. and 1 in. *Jas P Marsh Corp, 2073 Southport Ave, Chicago, Ill.*

Sweeping Compound

FIBRE-TEX FLOOR CLEANING COMPOUND is said to eliminate danger of fire usually inherent in materials of this type. It is claimed that compound is highly absorbent of oils and greases and has active cleaning effect upon floors on which it is consistently applied. Grease and oil-caked dirt are said to be removed; safety stripes and other floor

A Giant Deaerator that Saves Steel in Two Ways



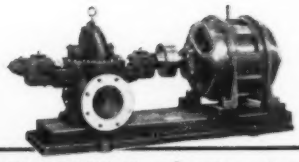
Built of Cast Iron, it Saves Steel for War Production: By Removing Oxygen from Feedwater, it Saves the Steel Feed System and Boilers from Corrosion.

The Cochrane Deaerator shown here and built for a large plant is one of the largest ever built of cast-iron, sectional joint construction. It has a deaerating section having a capacity of slightly less than 1,000,000 lbs. per hour mounted on a large storage section of the same construction. It is one of two such deaerators for this plant. Cochrane's experience in building equipment of this character for special conditions is exemplified in this huge apparatus.

COCHRANE CORPORATION • 3106 N. 17th STREET • PHILADELPHIA, PA.

COCHRANE

SOFTENERS • DEAERATING SOFTENERS • DEAERATORS • METERS • STEAM SPECIALTIES



Fighters on the WARREN PUMP Production Front . . No. 3 of a Series

CHARLIE DOESN'T HAVE TO DO IT BUT HE DOES IT . . FOR UNCLE SAM

Charlie Ball was, *and is now again*, a Warren Pump toolmaker extraordinary.

It's this way. After more than 30 years of loyal, skillful service here at Warren, Charlie retired to take his well-earned ease . . . or do whatever else he pleased.

When our country was attacked . . . our Navy, our Merchant Marine, our War Industries needed more and more Warren Pumps. And Charlie, prompted only by his heart and patriotism, came back to help. With all his skill and experience, he is making a *real* contribution to the defeat of the Axis.

Charlie Ball and Warren Pumps have much in common . . . both are "built to fit the job" and can be counted upon for a long lifetime of reliable and economical performance.

WARREN PUMPS

WARREN STEAM PUMP COMPANY, INC.
WARREN, MASSACHUSETTS

markings made plainer, and, in general, plant housekeeping greatly improved. Packed in 50-lb cartons. *Lacey-Webber Co, Kalamazoo, Mich.*

Emergency Lighting Unit

LIGHTGUARD EMERGENCY LIGHTING UNIT for wartime service requires no fixtures other than plug-in connections to a-c supply. Designed to meet need for emergency lights in war plants, shipyards, factories, for use where workers are employed at night on machines, particularly in crowded spaces; for emergency lighting at control equipment, electrical

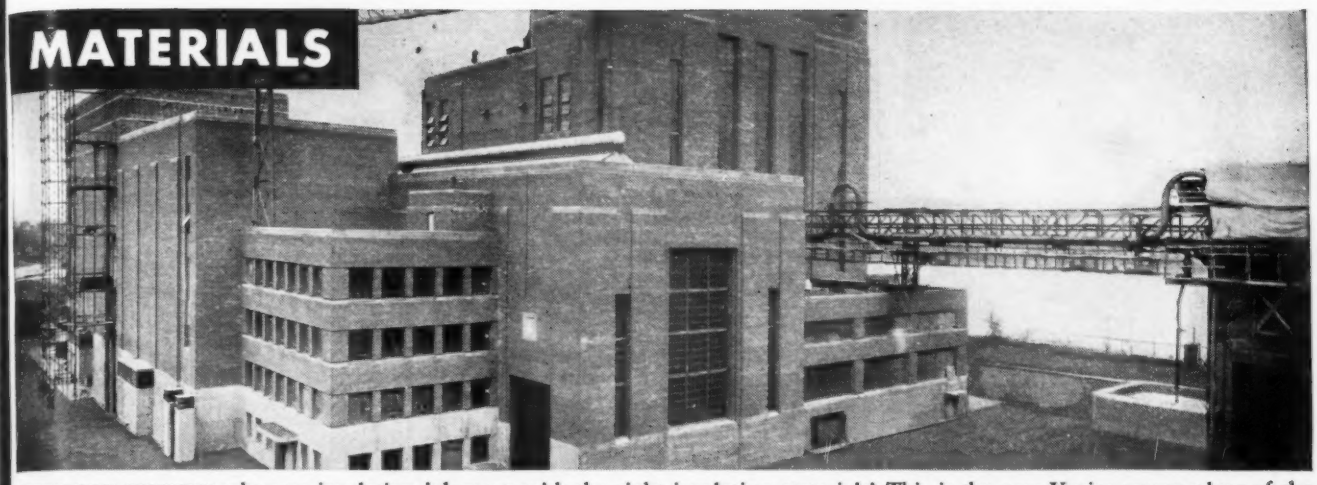
or mechanical, such as power switchboards, pumps and valves; in boiler and engine rooms for reading gages and operating valves; entrance and exit locations; first-aid stations, and plant dispensaries. *Electric Storage Battery Co, 19th St & Allegheny Ave, Philadelphia, Pa.*

Finned Tube Heat Exchanger

"SHELLFIN," A STANDARDIZED HEAT EXCHANGER, can be used for many forms of heat exchange between two fluids in medium temperature ranges where temperature of one fluid materially exceeds that of the other. Adapts perfectly to cooling, heating, condensing and evaporating processes. Standardized construction eliminates usual preliminary engineering; unit selection can be made easily. Features and construction throughout have a'' the quality of the finest "custom-built" heat exchangers, according to manufacturer. *Downington Iron Co, Downington, Pa.*

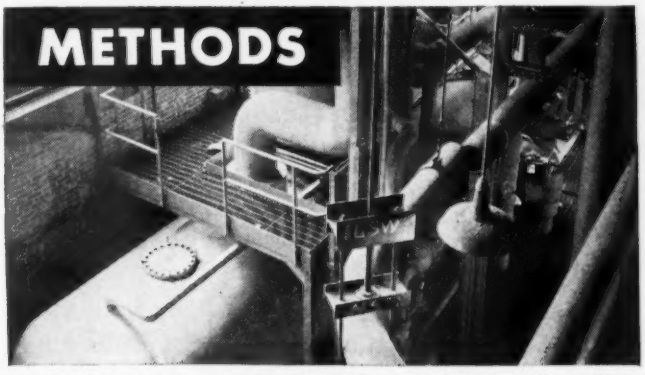
Spring Tester

COMPRESSION SPRING TESTER in sizes to 2½ in. diameter and 7-in. length measures recoil pressure of spring when compressed to any predetermined length, and makes possible to



EVERYBODY BENEFITS when an insulation job starts with the right insulating materials! This is the new Venice power plant of the Union Electric Company, built by Stone & Webster. The Ruberoid materials which went into it are: 85% Magnesia, high temperature molded insulation, "48" Mineral Wool insulating blocks and insulating cements.

THEY HAVE "KNOW HOW." Ruberoid Approved Applicators, such as the St. Louis Insulation Co., St. Louis, Mo., who made the Union Electric Plant installation, are men with many years of experience. Ruberoid offers this service in all principal areas.



DOING IT THE RIGHT WAY. Individual problems and working conditions are always different and a thorough understanding of them is necessary to determine the method of application. Ruberoid gives you the right method *with* the right material.

More Warpower for Manpower with Ruberoid Thermal Insulations

Another super plant built to feed more power to vital war industries! Insulation had to be right! ... to the last specification ... to the last working detail.

Three things make the Ruberoid system most suitable to the specific needs of power plant operation.

1. Insulating problems up to 2100° F. can be met with specific Ruberoid materials, developed especially for each temperature range and condition.

2. The men who work with these materials are insulating technicians, all Ruberoid approved applicators.

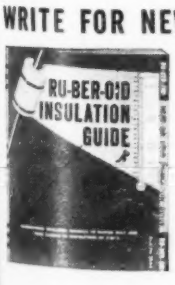
3. Then, the Ruberoid system teams up the right *method* with the right material and the right men for the job! You get: Top insulating efficiency!

That's why the Ruberoid way is the best way to insulate!

RUBEROID INSULATION PRODUCTS

Imperial Asbestos Insulation
85% Magnesia Insulation
Air Cell Pipe Covering
Woolfelt Pipe Covering
Sponge Felt Pipe Covering
Mineral Wool Insulations
High Temperature Insulations
Low Temperature Insulations
Asbestos Papers & Boards
Insulating Cements

WRITE FOR NEW INSULATION GUIDE



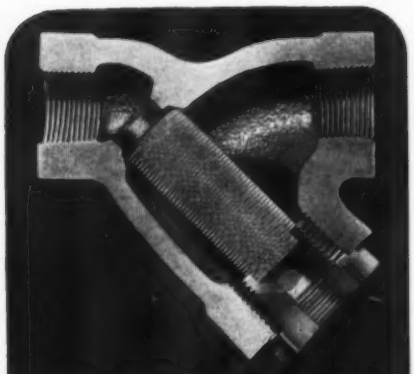
Side index gives, in seconds, the temperature you are interested in and the material for it. For free copy address
The RUBEROID Co.,
Dept. P-6,
500 Fifth Ave., N.Y., N.Y.

MATERIALS, MEN, METHODS—all 3 with

RU-BER-OID

THERMAL INSULATIONS

Service to Industry since 1886 ... Genuine **RU-BER-OID** *Roofings and Building Products*



We Didn't Want to Make Strainers

BUT we needed them for use with Yarway Steam Equipment and couldn't find any to suit us.

So we designed the *YARWAY Strainer.*

Apparently a lot of other people were having "Strainer trouble" because, without a line of advertising, the Yarway Strainers *purchased* in a few years now number *many thousands.*

Why don't you look into this better Strainer for your money? Buy one from your supply house (over 100 Mill Supply Houses now have them).

See its protection against corrosion—*cadmium plating inside and out.*

Examine its *high grade Monel woven wire screen* that stops dirt—lets condensate or other fluids flow freely.

Notice the removeable blow-off bushing. Screen and bushing come out together—go back together, *automatically aligning.*

Six standard sizes from ½" to 2" for pressures to 600 lb.

See your Mill Supply House or write for Bulletin S-200.

●

YARNALL-WARING COMPANY
100 Mermaid Ave. PHILADELPHIA

YARWAY STRAINERS

match sets of springs accurately. Also used for proof-testing strength of press fits and for light arbor press production operations where they permit rapid application of accurately gaged pressures. *P A Sturtevant Co, Addison, Ill.*

Industrial Maintenance Paint

PROTECTITE, GENERAL ALL-AROUND INDUSTRIAL MAINTENANCE PAINT, is adapted for protecting metals against corrosion and high temperatures. Protecting film deposited by compound is composed of a hard inert processed carbon-silicate complex substance used only and exclusively by manufacturer. Film is waterproof, tough, flexible, long wearing and finish is anti-slip (even when wet) to foot traffic. Furnished in two colors, black and battleship gray, in mat and glossy finishes, is adaptable for use on metal, concrete, brick, and other surfaces exposed to weather or inside locations. *J Merrill Richards, 25 Huntington Ave, Boston, Mass.*

Dynamic Balancing Machines

BEAR DYNAMIC BALANCING MACHINES help industrial machine parts perform more efficiently after being balanced statically and dynamically. May be used for armatures, fans, lathes, gears, crankshafts, pulleys, motors, "in fact anything that rotates." Said to prevent excessive and needless wear, noise and vibration. *Bear Mfg Co, Rock Island, Ill.*

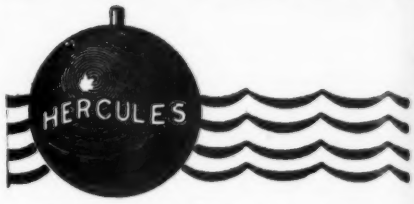
Insulating Brick

ZONOLITE INSULATING BRICK is composed of specially sized granules of Zonolite insulation which are molded together with suitable clay binders. Zonolite is an inert, featherweight, resilient material manufactured by exploding an unusual mineral which is an alteration product of mica. Designed primarily as backup insulation for refractory brick in service range up to 2,000 F—has very low heat-absorbing capacity, greatly increased efficiency of intermittent furnace operations, according to manufacturer. *Universal Zonolite Insulation Co, 135 S La Salle St, Chicago, Ill.*

Voltage Tester

VOLTAGE TESTER reads like thermometer; no meter, no switching, no tip jacks. Simple to use: Connect needle pointed test prods across any electric line. Instrument indicates automatically what voltage is, if current is ac or dc.

HERCULES
Seamless Copper
FLOATS



GUARANTEED TO STAND UP!

Every Hercules Float carries our guarantee to stand up under 350 lbs. working pressure and 500 degrees temperature.

Fabricated of seamless copper under our special spinning process. Hercules Floats are uniform in thickness and high in mechanical strength.

You can depend on Hercules for floats—in standard shapes up to 10 in. and in special types to your specifications—to give long, dependable, economical service.

Insure care-free maintenance of water level in your heaters, tanks, reservoirs and other equipment by specifying "HERCULES."

HERCULES FLOAT WORKS
200 Franklin St.
SPRINGFIELD, MASS.

Why
ROCKWELL BLAST GATES
assure accurate control of low-pressure air lines

Skillful design, accurate machine work, and rigid factory tests assure air-tight closure. Graduated dials provide exact setting and resetting.

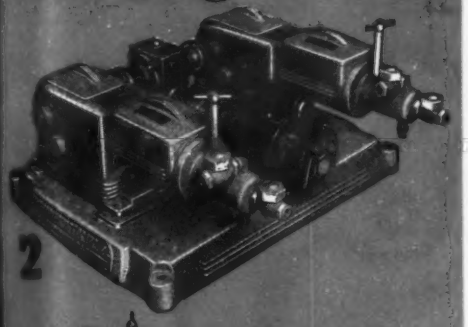
Additional important advantages of Rockwell Blast Gates described in Bulletin 4020 . . . sent on request.

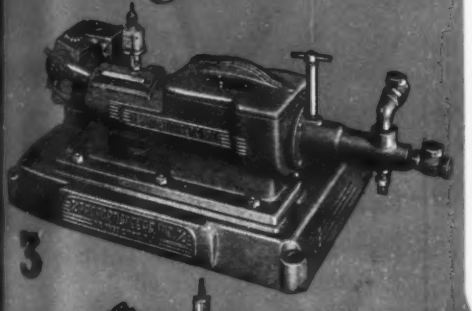
Made in all types . . . Slide, Kwikleen, Butterfly, Pull and Water; with lever, handwheel or chain wheel control.

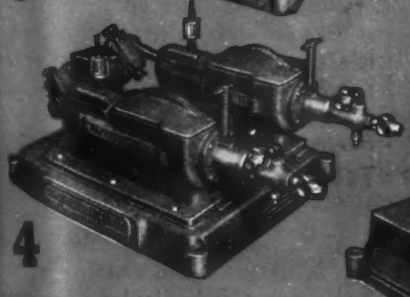
W. S. ROCKWELL COMPANY
Blast Gate Division
50 CHURCH STREET NEW YORK, N.Y.

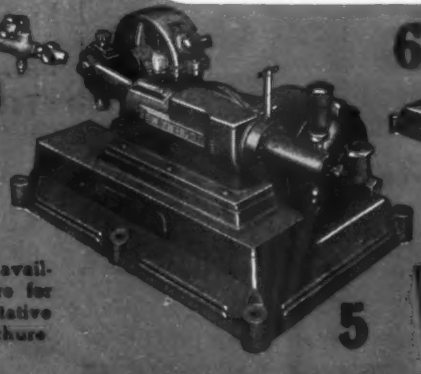
A Complete Line
CHEMICAL PROPORTIONING PUMPS
for the Power Plant

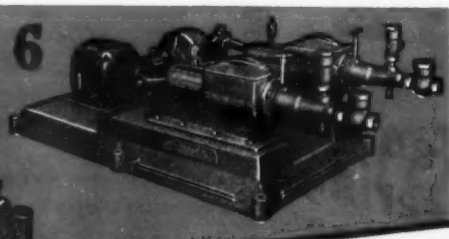
1


2


3


4


5


6

Get positive protection against scale, corrosion and embrittlement with Heavy Duty Adjust-O-Feeder Proportioning Pumps for phosphates, sulphites, sulphates, water treating chemicals and prepared compounds.

1. **MODEL 1XS** ***Midget Series Simplex*** *Adjust-O-Feeder*
   Up to 7.5 g.p.h. 1,000 p.s.i.g.
2. **MODEL 1XD** ***Midget Series Duplex*** *Adjust-O-Feeder*
   Up to 15 g.p.h. 1,000 p.s.i.g.
3. **MODEL 2XS** ***Standard Simplex*** *Adjust-O-Feeder*
   Up to 42 g.p.h. 500 p.s.i.g.
4. **MODEL 2XD** ***Standard Duplex*** *Adjust-O-Feeder*
   Up to 84 g.p.h. 500 p.s.i.g.
5. **MODEL 2XS** ***High Pressure Simplex*** *Adjust-O-Feeder*
   Up to 50 g.p.h. 3,000 p.s.i.g.
6. **MODEL 3XD** ***High Pressure Duplex*** *Adjust-O-Feeder*
   Up to 100 g.p.h. 3,000 p.s.i.g.

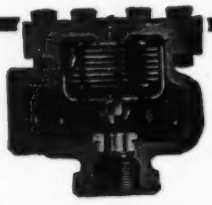
Certified dimension prints available by return mail. Wire for name of nearest representative or write for special brochure

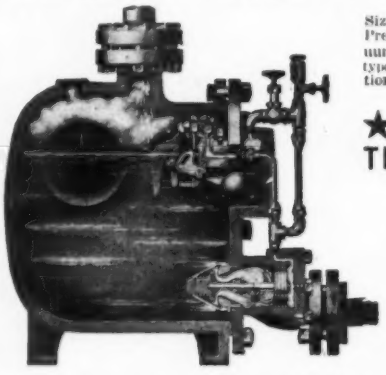
FEATURES — MICROMETER stroke adjustment, FLUID-SEALED plunger and stuffing gland, needle bearings, visible capacity scales, long cross-head guides, interchangeable disc or built-in ball check valves. Each pump tested under job conditions. Certified calibration curves with each unit.

% PROPORTIONEERS, INC. %
16 CODDING ST., PROVIDENCE, R. I.

It Takes a Trap with Guts to Stand the Gaff of America's Round-the-Clock War Production

Nicholson Thermostatic Type Industrial Traps Provide Large Capacity . . . Long Life . . . 100% Efficiency.





Sizes ¼" to 2" . . . Pressures from vacuum to 300 lbs . . . types for all applications.

★ SPECIALLY DESIGNED TRAPS FOR SUPERHEATED STEAM SERVICE

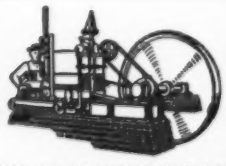
For dependable efficiency and economical durability, Nicholson makes a complete line of high pressure traps. Weight Operated for pressures to 1500 lbs.—Piston Operated for pressures to 650 lbs. Several models, various constructions, numerous sizes—for all purposes.

CATALOG No. 941—W. H. NICHOLSON & CO., 125 OREGON ST., WILKES-BARRE, PA.

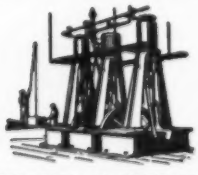
NICHOLSON Traps

THERMOSTATIC ▼ PISTON AND WEIGHT-OPERATED STEAM GASOLINE AND COMPRESSED AIR TRAPS ▼▼▼

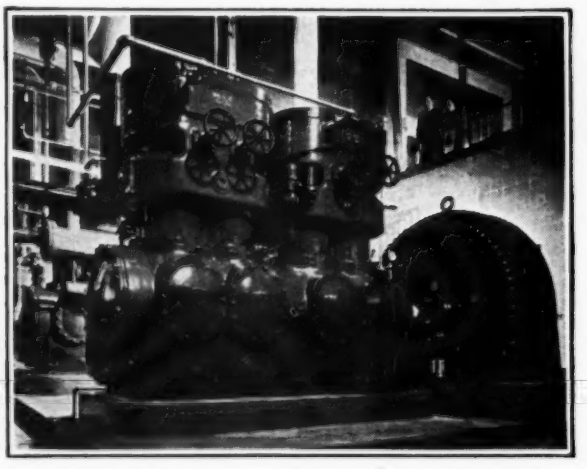
CONTROL VALVES ▼ FLOATS ▼ MANDRELS ▼ STEAM AND AIR SEPARATORS



FRICK STEAM ENGINE, BUILT 1856 NOW IN THE FORD MUSEUM



FRICK REFRIG. MACHINE OF 1883



90 Years' Engineering Experience Stands Behind

To be within ten years of its One Hundredth Anniversary is a distinction enjoyed by very few companies in America.

Frick Company was established in 1853 for the building of steam engines. The success of these led to the construction, in 1882, of the first Frick Refrigerating machine.

Today, Frick cooling systems are put into war service as fast as they can be made. Tomorrow, you can get the advantages of up-to-date Frick Refrigerating, Ice-making, and Air Conditioning Equipment, backed by more than 90 years' experience.

FRICK COMPANY, WAYNESBORO, PENNA., U. S. A.

TRADE FRICK MARK

Refrigeration

if appliance connected in the line is "open", if frequency is 25 or 60 cycles, if fuse is blown, etc. *Superior Instrument Co, Dept T, 227 Fulton St, New York, N. Y.*

Bushings

PINCO DRY-TYPE EQUIPMENT BUSHINGS for use on voltages from 7.5 kv up to and including 25 kv, for use with currents up to 400 amp, are made of standard Pinco high-voltage, high-quality porcelain. All joints are properly

gasketed and every bushing given a careful checking over under substantial pressure to insure satisfactory operation under either oil or gas conditions. Furnished in either draw-lead or fixed-type terminals as specified by customer. *Porcelain Insulator Corp, 442 Main St, Lima, N. Y.*

Tube Cleaner

TUBE CLEANER was especially designed to clean small-diameter tubes (⅜ to 1¼ in. ID) used in condensers, heat exchangers, and similar apparatus. Unit operates at high speed and uses a "cutter-bit" which it is stated will not clog or jam so as to damage or break either the shaft or the "cutter-bit" itself. Its unusually high operating speed enables tubes, which heretofore were considered unprofitable to clean because of the time and trouble involved, to be cleaned quickly and economically. In conjunction with the development of the new tube cleaner, the company has designed an attachment which gives to the "cutter-bit" the

AIR is LIFE to a sub crew...

but DEATH to unstable turbine oils!

WHEN oxidation attacks, unstable oils can't last long. That's why turbine operators are switching to the new Shell Turbo Oil. There's not another turbine oil today that can match its ability to resist oxidation.

For positive proof, check the 19,851 hrs. performance record of the Norton Co., abrasive manufacturers, shown below. It is but one of the scores of examples that prove Shell Turbo Oil not only has superior oxidation stability—it also prevents rust!

For further details on this and other outstanding performances of Shell Turbo Oil call in the Shell man. Or, write Shell Oil Company, Inc., Dept. "B", 50 W. 50th St., New York, N. Y., or 100 Bush St., San Francisco, Cal.

Certified Proof of the Superior OXIDATION STABILITY of Shell Turbo Oil

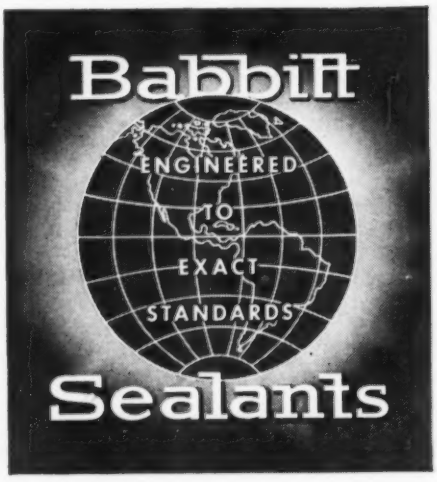
CHARACTERISTICS		
156	*Viscosity @ 100° F.*	157
Clear	*Appearance*	Clear
LT .05	*Neutralization No.*	.02
LT .2	*Saponification No.*	.2
90	*Steam Emulsion No.*	90

Performance record of Shell Turbo Oil in 2500 kw. unit of the Norton Co., Worcester, Mass.

SHELL TURBO OIL

Currently, the U. S. Navy has first call on Shell's entire production of marine turbine oil

SHELL



SEALING SPECIALISTS for INDUSTRY

For more than half a century, Babbitt specialties have been internationally known throughout industry. In the field of scientific sealants, one of the foremost names has been Namco, Inc. These two well-known names are now combined.

BABBITT *Plastic* SEALANTS

Joint and Gasket Compounds

were developed through the research facilities and field experience of the Babbitt and Namco organizations. These sealants have been scientifically formulated to hold steam, water, oils, and other liquids, chemicals, solvents, and gases, yet retain permanently workable joints.

Throughout industry there are countless applications for Babbitt Plastic Sealants in plant maintenance, on operating equipment and for "on product" use. Since Babbitt Sealants never "cement" a joint, speed and efficiency in pipe line maintenance are increased, and valuable savings in manpower and material are made possible.

If you have a sealing problem of any kind, the chances are that there is a Babbitt Plastic Sealant to solve it.

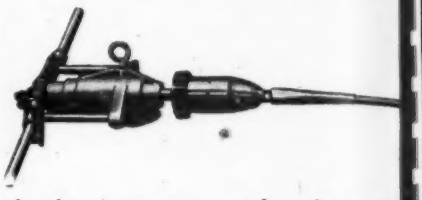
THE STORY OF SEALANTS: *This new, 12-page book describes the development of Babbitt Plastic Sealants, their uses and applications. Write us on your letterhead for a copy.*

Babbitt
All Over the World

BABBITT INDUSTRIAL SPECIALTIES CO.

International Building
Suite 3155, 45 Rockefeller Plaza, New York

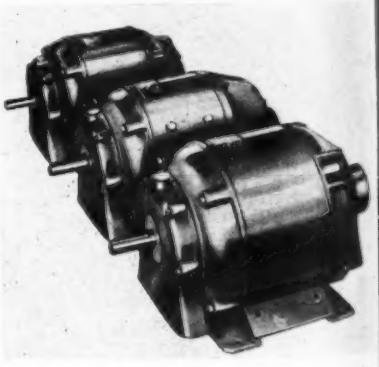
combined movement of a rotary tube cleaner and a percussion hammer by adding to the rotation of the "cutter-bit" a series of blows which quickly break up the hardest deposit, and also assist the bit to obtain a bite on the deposit. The attachment is operated



by the air or steam used as the scavenging agent in the tube cleaner. Its use is also recommended for cleaning either partially or totally plugged tubes in which an especially hard deposit is encountered. *Thomas C Wilson, Inc, 21–11 44th Ave, Long Island City, N. Y.*

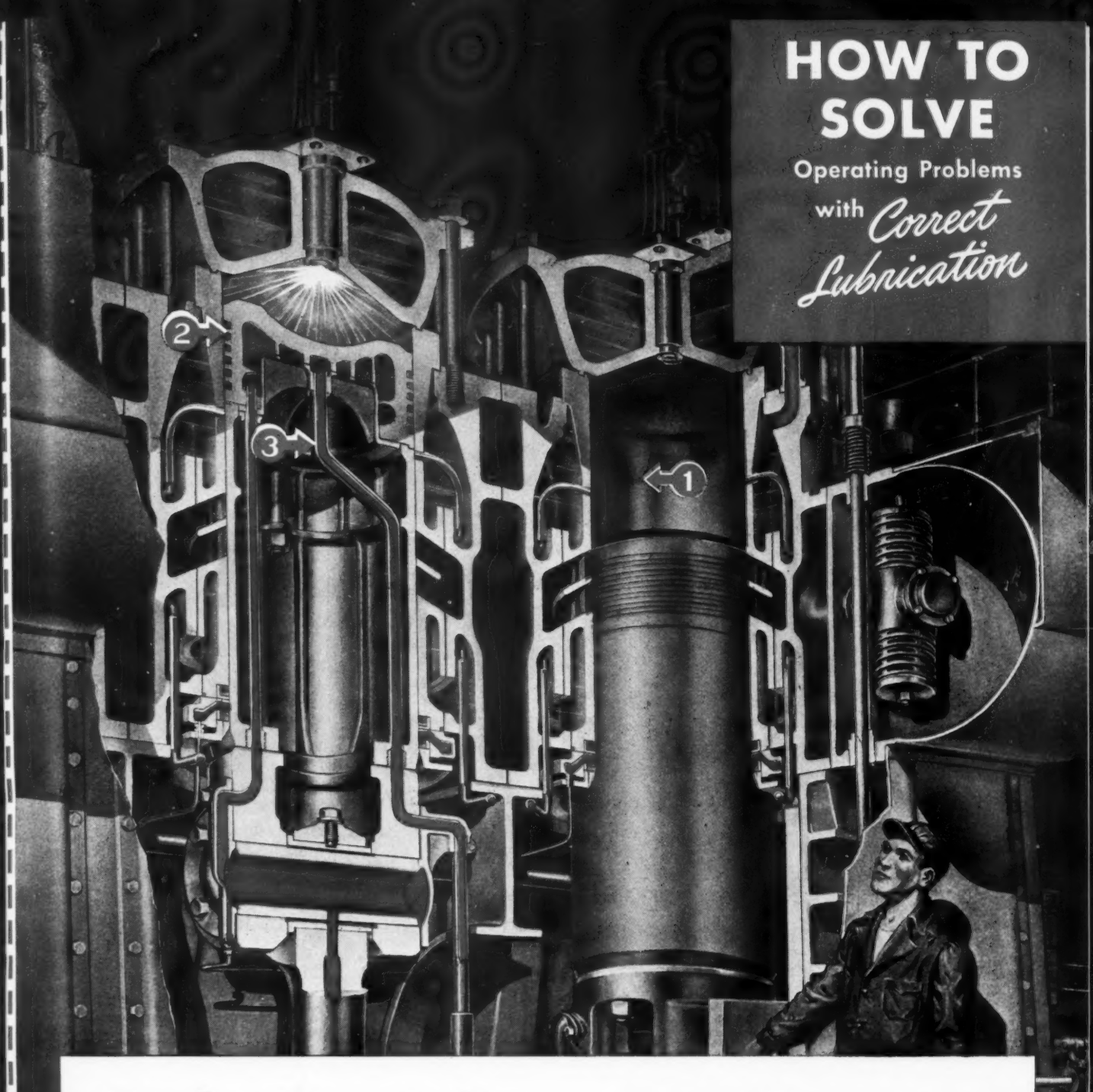
Electric Motors

UNI-SHELL ELECTRIC MOTORS said to be only complete line in which all motor types in any one frame size are interchangeable. All these motors are built within cylindrical shells of steel. In any one frame size, the shell dimensions, head fit, bolt-circle holes, shaft size and conduit-box mountings are identical for all motor types. This is true of polyphase induction, capacitor start induction, standard dc motors and generators, repulsion induction motors and other types. *Robbins & Myers, Inc, Dept 26-M, Springfield, Ohio.*



Megger Insulation Resistance Tester

MEGGER ELECTRICAL INSULATION RESISTANCE TESTERS are now built in new designs in the United States. These new units are of the hand-operated generator direct-reading ohmmeter type—the same general design as the Biddle meg and super-meg models. New instruments are inclosed in cases of molded high-impact-strength plastic material, various parts of which are made fit to-



HOW TO SOLVE

Operating Problems with *Correct Lubrication*

Fight Heat, Pressure, Oxygen

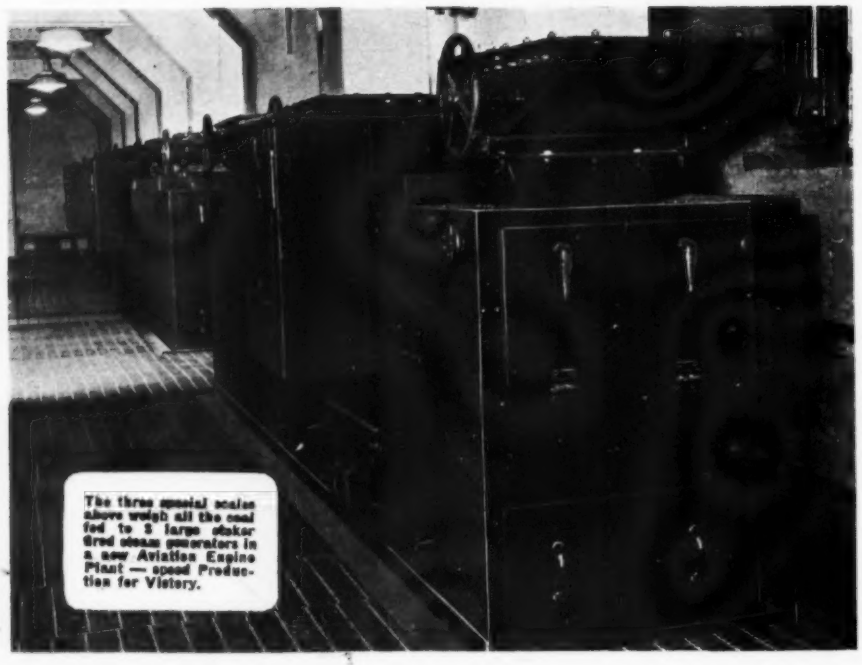
PROBLEM: Heat, pressure, oxygen attack a Diesel lubricant between the faces of the rings and the cylinder wall (1, above) and between the rings and grooves (2, above). Its use as a coolant (3, above) also subjects it to oxidation. The lubricant must resist these attacks or it will form deposits, interfering with ring action and piston cooling.

ANSWER: A line of famous Gargoyle Oils is made specifically for this purpose: *Gargoyle D. T. E. Oils Nos. 1 to 5.* In even the most severe Diesel operation, these oils resist oxidizing influences. They form a tenacious film that resists the wiping action of the piston rings. Wear, ring breakage and blow-by are all minimized. Piston cooling remains at maximum efficiency.

GARGOYLE Lubricants

SOCONY-VACUUM OIL COMPANY, INC. — Standard Oil of N. Y. Div. • White Star Div. • Lubrite Div. • Chicago Div. White Eagle Div. • Wadhams Div. • Southeastern Div. (Baltimore) • Magnolia Petroleum Co. • General Petroleum Corp.

CALL IN SOCONY-VACUUM


The three special scales above weigh all the coal fed to 8 large stoker fired steam generators in a new Aviation Engine Plant — speed Production for Victory.

Facts FOR EFFICIENT STEAM PRODUCTION

MORE STEAM from LESS COAL

How much coal are you burning? What is the evaporation rate of your boiler plant? Is each boiler doing its best? Are you getting all the steam you can per pound of coal? Could the total steam production of your plant be increased?

Richardson Automatic Coal Scales provide accurate answers to these questions—give undisputable facts to assist plant engineers in boosting steam production—increasing efficiencies—and obtaining maximum operating economy.

Don't guess—Rely on facts.
Write for information.

Specialists in Automatic Weighing and Conveying

RICHARDSON

RICHARDSON SCALE COMPANY, CLIFTON, N. J.

Atlanta Boston Chicago Minneapolis Montreal New York
Omaha Philadelphia San Francisco Pittsburgh Toronto Wichita

3789

gether to form strong, compact and dustproof units. These Megger instruments are now being built with 500-v generators and ranges of either 100 or 1000 megohms. Value of insulation resistance under test is indicated directly by position of pointer on scale, the same as a voltmeter indicates volts. *James G Biddle Co, 1211-13 Arch St., Philadelphia, Pa.*

Vibratory Conveyors

ILLUSTRATION SHOWS 35-ft section of 130-ft long flat pan type conveyor for handling extremely hot materials. The conveying action of this unit, as in all company units, is accomplished by high-speed vibration set up by multiple pulsating driving magnets. Control of the rate of flow of material through the

conveyors is by rheostat from either close by or from a remote point. Units are addition to standard line. Trough styles can be supplied in either flat pan, as illustrated, or in sealed, tubular sections with or without multiple intake openings or multiple discharge gates at various points. *Syntron Co, Homer City, Pa.*

Unit Springs

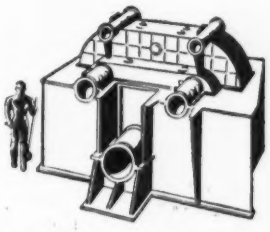
RANDE UNIT-SPRINGS embody a patented engineered spring construction with mounting which has universal action,

GEARED TO THE BIG JOB

Coupling Hendy marine turbines to the propellers that drive our "Bridge-of-Ships" are these smooth running Hendy reduction gears. Built to the highest precision-standards known in the American gear-cutting industry, they are produced in air conditioned, temperature controlled rooms—by time-saving, production-line methods.

Close meshing of these gears is typical of the coordination that exists among the "Iron Men of Hendy"—who have whole-heartedly geared their combined efforts to the "big job of today." Consistently ahead of schedules, they are delivering 2,500 hp and 2,750 hp steam engines and 4,000 hp reduction gear turbines. Soon they will be building even larger marine power plants—of over 8,000 horsepower.

When "the gears are shifted to peace," this skilled, dynamic organization will focus its efficient production methods on peace-time power—for industries that may need its skill and experience.



ANOTHER ACHIEVEMENT BY THE IRON MEN OF HENDY

. . . is the short time they required to erect plants, design tools, develop production methods, and the speed with which they are now delivering double-reduction gear units for marine turbines. The "bull-gears" for the 4,000 hp reduction gears are 104.6" in diameter, 14" helix; reduction ratio is 65:1.

JOSHUA HENDY IRON WORKS

ESTABLISHED 1856

SUNNYVALE • CALIFORNIA

Divisions: POMONA PUMP COMPANY
CROCKER-WHEELER ELECTRIC MFG. CO.

Manufacturing Plants: SUNNYVALE, LONG BEACH, POMONA and TORRANCE in CALIFORNIA • AMPERE, N. J. • ST. LOUIS, MO.
Branch Offices: NEW YORK • WASHINGTON • PHILADELPHIA PITTSBURGH • CHICAGO • ST. LOUIS • SAN FRANCISCO • LOS ANGELES

POSITIVE
Protection

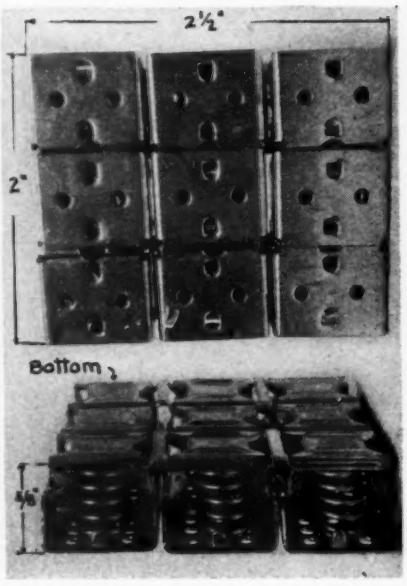
Yarway's unique Hi-Lo Alarm mechanism utilizes balanced *solid weights* that are as indestructible and unchanging as the metal itself. Operating on the displacement principle, they literally "weigh the water level."

When the high or low water emergency occurs—instant, positive, powerful, hair-trigger *action* results—giving warning of danger by whistle, light, or both.

Yarway Water Columns, eight standard models, iron bodies with screwed connections for pressures up to 250 lbs., forged steel bodies with flanged connections for pressures up to 1500 lbs., are fully described in Catalog WG-1809. Write for a copy and working model.

YARNALL-WARING COMPANY
100 Mermaid Ave. Philadelphia

YARWAY
FLOATLESS HI-LO ALARM
WATER COLUMN



taking thrust from any direction. Spring is always held firmly in place, yet has full floating motion at any time. All parts are of brass with alloy steel springs. Each cell deflects independently but cells are fabricated into a unit, as illustrated, on principle of a mattress. General-purpose unit shown is now available for immediate delivery on a priority of A-1 or better (March 29, 1943). Standard unit is of 9-cell construction, 100-psi load capacity and occupies a space of only 2½x2x⅝ in. Any cell can be removed and the base drilled to take an anchorage bolt, tightened to the point of starting deflection. *Rande Specialty Co, P O Box 708, Hoboken, N. J.*

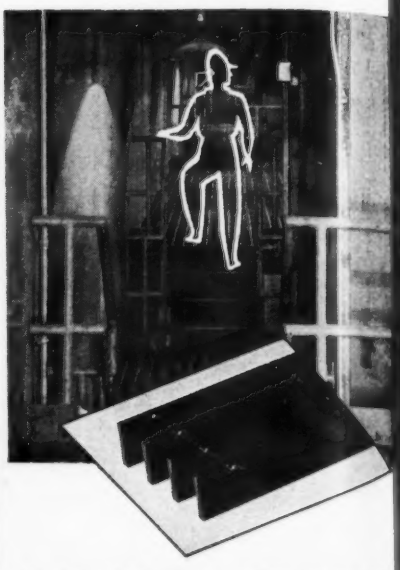
OGP Meeting

(*Continued from page* 130)

uled include: "Present Position and Future Prospects of Diesel Fuels," by A L Foster, *Oil and Gas Journal*; "Recent Developments in the Chrome-Plating of Engine Cylinders," by Russell Pyles, Van der Horst Corp of America; and "Experience with Chrome-Plated Rings," by Dr Tracy Jarrett, American Hammered Piston Ring Division, Koppers Co.

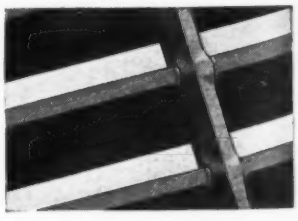
The session on maintenance of diesel engines in naval service will feature a paper presented by the Engine Division, Bureau of Ships, to be followed by prepared discussions from representatives of the various engine builders. This session will be held Monday afternoon, June 14. At the banquet that evening, Admiral Mills will be the principal speaker.

The inspection trip to the U. S. Naval



THE EXTRA STRENGTH
AND CLEANLINESS OF
BATES-GRATES
AT NO EXTRA COST

The clean fillet weld you see on that section of BATES-GRATES gives you a combination of maximum strength and floor safety that makes it very much worthwhile to specify BATES-GRATES for your open steel flooring.



Note the crisp, dirt-and-grease-shedding tread the entire length of the Hex Cross Bar. BATES, alone, gives you that, too.

8½" x 11" BOOKLET GIVES DETAILS. SHOWS MANY INSTALLATIONS

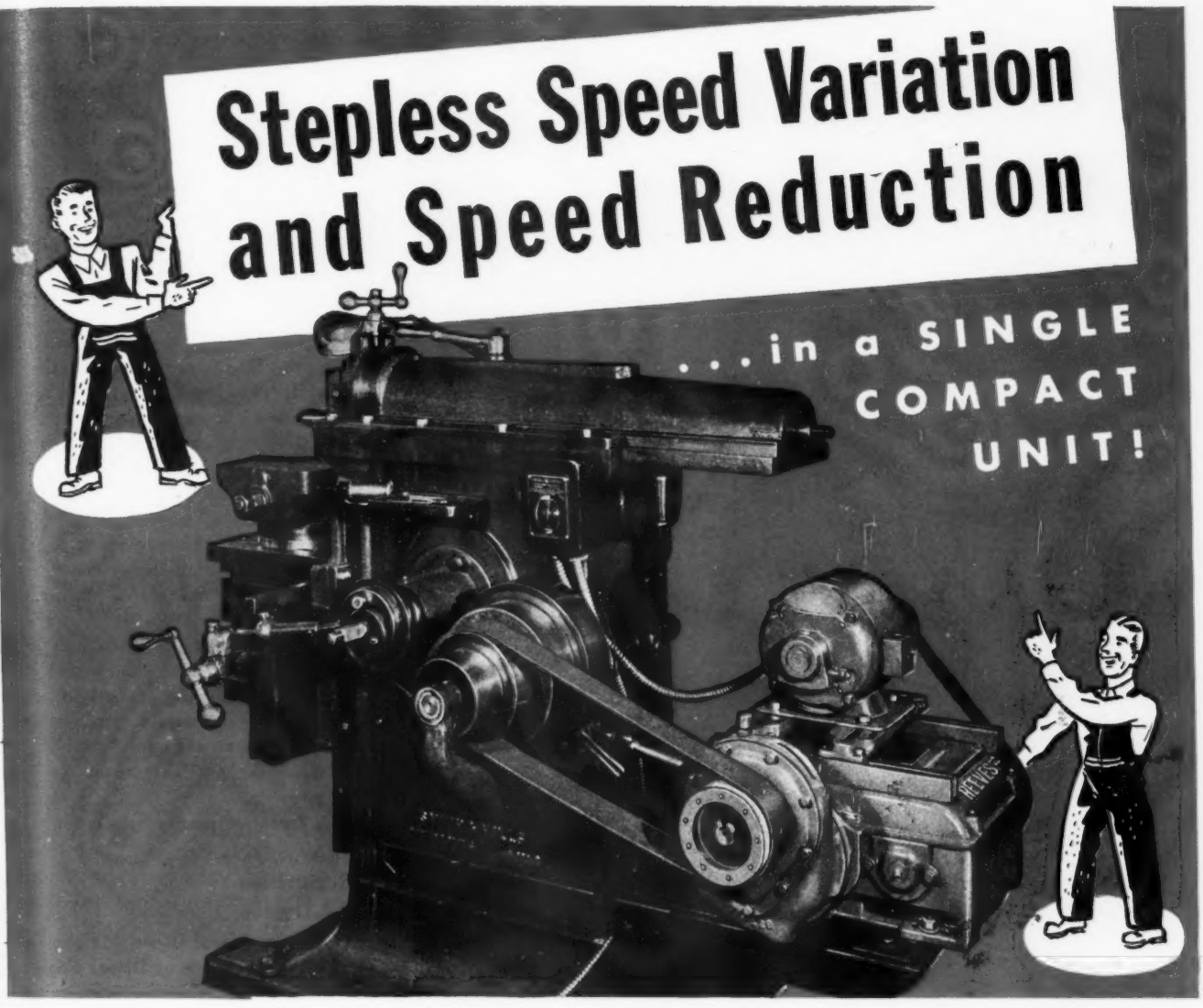
•

WRITE FOR COPY

WALTER BATES COMPANY, INC.
JOLIET, ILLINOIS
OPEN STEEL FLOORING • STAIR TREADS

Stepless Speed Variation and Speed Reduction

...in a SINGLE COMPACT UNIT!

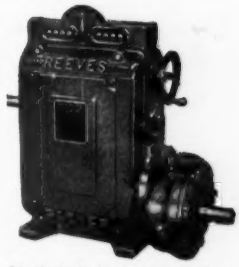


Pictured here is a REEVES Reducer-Type Transmission, horizontal design, with individual motor drive, applied to a shaper.

With this new REEVES drive, which consists of the famous REEVES Variable Speed Transmission and built-in, helical-type speed reducer, operator of any production machine has a wide range of low driving speeds instantly available in a single compact unit.

The entire range is covered without steps or jumps. Any required speed for best production under each changing condition is accurately obtained by turning a handwheel, without stopping driven machine or interrupting production.

It's easy to equip the REEVES Reducer-Type Transmission for individual motor drive by means of REEVES adjustable motor base, which will accommodate any available motor. Send for complete information. Use handy coupon below.



Vertical design is especially adapted for use where floor space is limited.

REEVES *Accurate-Variable* SPEED CONTROL

REEVES PULLEY COMPANY • COLUMBUS, INDIANA

Send copy of 16-page Catalog PTR-432 giving complete engineering information on the new REEVES Reducer-Type Transmission.

NAME OF FIRM.....

INDIVIDUAL.....ADDRESS.....

CITY.....STATE.....

Two panels of actual use-pictures of power plant and shop applications with attached folding 7-page descriptive booklet, offer many and varied know-how-to-use directions and suggestions which will prove very helpful to even the most experienced users of Dixon Graphites.

THE EXCELLENCE OF THESE GRAPHITES REMAINS UNCHANGED

In their new instructive packages, these graphites will continue to provide in even wider scope, distinctive service values in reducing FRICTION and OVERHEATING attending EXTREME BEARING PRESSURES and HIGHER SPEEDS and for COATING GASKETED, THREADED and FLANGED PIPE JOINTS and in many other similar and widely different services.

• • •

THE NEW KNOW-HOW PACKAGE IS NOW AVAILABLE *ONLY* IN THE FOLLOWING SIZES

5 & 10 Lb. Ticonderoga No. 1 (Large Flakes)
5 & 10 Lb. Ticonderoga No. 2 (Medium Powdered Flakes)
5 Lb. No. 635 (Finely Powdered Flakes)

All other size containers of these Graphites including MICROFYNE (extra finely powdered flakes), are still being packed in the previous style packages, which will be changed as soon as new containers are obtainable.

JOSEPH DIXON CRUCIBLE COMPANY, JERSEY CITY, N. J.

Pipe Joint Compound • Graphite Seal • Graphited Oils • Cup and Pressure Gun Grease • Gear Lubricants • Waterproof Graphited Grease • Auto-Marine Grease • Graph-Air Guns • Lathe Center Graphite Lubricant • Belt Dressing (Contains no Graphite).

3693

Experiment Station will be limited to 150, and proper credentials, including proof of citizenship, must be presented. This trip will highlight the activities of Tuesday, June 15. Another inspection trip of unusual interest will be made on Wednesday evening, June 16, to the plant of the American Hammered Piston Ring Division, Koppers Co. Here the engineers attending will see the manufacture of piston rings from the small precision rings used in aircraft engines to the giant rings used in the low-pressure cylinders of Liberty Ship reciprocating steam engines, the new metallurgical laboratory, and recently completed chrome-plating plant. This trip also will be limited to those presenting proper credentials.

At the exhibit held in connection with the conference, more than 20 leading manufacturers of engines and accessories will display the latest in equipment and research developments.

Because Baltimore is a war-boom city and hotel accommodations are in great demand, those planning to attend the Conference are advised to send in reservations promptly and, wherever possible, to arrange for "doubling up" to make the available rooms go as far as possible.

A tentative program follows:

Monday, June 14

Registration

Get-Together Luncheon

Session on Naval Diesel Maintenance

"Maintenance of Diesel Engines in Naval Service"—Paper presented by Engine Division, Bureau of Ships, Navy Dept to be followed by prepared discussions from representatives of engine builders.

Informal Banquet

Rear Admiral Earl Mills, Asst Chief, Bureau of Ships, Navy Dept. will be principal speaker.

Tuesday, June 15

Session on Engine Design

"Investigation of Large Diesel-Engine Wristpins"—by Frank E Faast, Navy Dept.

"A New Approach to Stress-Strain Calculations for Connecting Rods"—by Otto R Spies, Baldwin Locomotive Works.

Luncheon and Inspection Trip

U. S. Naval Experiment Station

Wednesday, June 16

Session on New Developments

"Present Position and Future Prospects of Diesel Fuels"—by A L Foster, *Oil and Gas Journal.*

"The Supersonic Reflectoscope for Inspecting Materials"—by Prof F A Firestone, University of Michigan.

Koppers "C & C"* Projects

*Current and Contemplated

Better roofs may be born in an igloo

Tar and Chemical Division

1 Current

Koppers Coal Tar Products "keep your powder dry"— In concrete "igloos" covered with ground, the Army keeps its powder dry and safe from enemy eyes. This is fine for the powder but hard on concrete. To protect the concrete and exclude water, many of these igloos are sealed in watertight "blankets" of Koppers coal tar pitch and tar-saturated fabric and felt.

2 Contemplated

More roofing products may soon be available for non-war use— Many of the biggest wartime building projects are well along toward completion. More coal tar pitch roofing may soon be available. This will be good news for anyone who has roofing work to be done, because coal tar pitch and tar-saturated felt are such long-lasting materials.

Bartlett Hayward Division

3 Current

Koppers Fast's Couplings drive the "Alligator Boats"— When American amphibian tanks plow through the water toward an enemy shore and then crawl up out of the water and lumber on across the ground, Koppers Fast's Couplings transmit the dependable power that drives them on land and sea.

4 Contemplated

Fast's Couplings will drive more and more of industry's wheels—On blowers, motor generator sets, on speed reducers, on conveyors and in dozens of places Self-aligning Fast's Couplings provide the best guarantee against shut-downs. The load-bearing surfaces are protected against wear by a positive film of oil.

Koppers Company and Affiliates, Pittsburgh, Pa.

KOPPERS

THE INDUSTRY THAT SERVES ALL INDUSTRY

ALLPAX

THE PACKING THAT "PACKS ALL"

. . . use it once and

. . . you'll use it always

THE ALLPAX CO., INC.

Mamaroneck, N. Y.

•

Distributors Everywhere

Here's the universal packing that can be used for any fluid or on any apparatus. One size packs all—economically, efficiently—tightly—simply.

Try ALLPAX and you, too, will be enthusiastic over its easy application and long wear. You don't have to remove old packing to repack with ALLPAX. Square cross section makes ALLPAX easy-filling in any stuffing box.

Try it and you'll always use it. Full details on request.

PYREX BROAD

Chief Engineer Martin's Assistant has joined the Marines...

Two of his men have been drafted—a third is working in an airplane factory. That's the story in a good many power plants. And when a plant is short-handed, changing a broken or leaky gauge glass is more of a nuisance than ever.

You know that *all* gauge glasses make trouble when improperly installed. If a glass is too long or too short, it soon needs attention. If it's badly aligned, it's subjected to ruinous stresses. If the wrong washers are used, grief will result.

You also know, as well as we do, that *all* gauge glasses give out. No gauge glass in the world resists steam action indefinitely. Sooner or later it wears thin at the top, but—PYREX gauge glasses wear *later* instead of *sooner*. They last longer, and that's why thousands more engineers are today telling their jobbers to send them PYREX glasses. And for added value, they ask for PYREX Broad Red Line glasses—the kind that are easy to read from a distance. It's a lot more than a play on words to say it pays to save steps when you're short-handed.

"PYREX" is a registered trade-mark and indicates manufacture by Corning Glass Works, Corning, N. Y.

CORNING Glass Works Corning, New York

Pyrex Gauge Glasses

Session on Rings and Liners

"Recent Developments in Chrome-Plating of Engine Cylinders"—by Russell Pyles, Van der Horst Corp of America.

"Experience with Chrome-Plated Rings"—by Dr Tracy Jarrett, American Hammered Piston Ring Division, Koppers Co.

Inspection Trip

Power Lines

(*Continued from page* 130)

attended the nearby country school and later Grinnel College Academy and Cornell College at Mt. Vernon, Iowa from which he was graduated with a literary degree in 1890.

He took an absorbing interest in smoke abatement and combustion efficiency, and he soon produced fuel savers and waste detectors in many forms. Among the first was an improved portable flue gas analyzer or orsat. Later came a CO_2 recorder for which Mr Hays and his brother Charles were awarded a Certificate of Merit by the Franklin Institute of Philadelphia.

In 1918 Mr Hays moved from Chicago to Michigan City. Here conducted a very successful instrument business besides acting as consultant on combustion problems. The consulting end of the business grew to the point where Mr Hays felt it was advisable to get rid of the responsibilities of the manufacturing end, so in 1925 he sold out to Phil T Sprague who had been selling instruments for Mr Hays. At this time the name of the manufacturing business was changed from The Joseph W Hays Corporation to The Hays Corporation which now ranks among the leaders in the manufacture of combustion instruments and control.

(A more complete biography of Jos W Hays will appear in the July issue of POWER.)

OBITUARIES

H F T Erben, 77, former manager of the **General Electric** Schenectady works, died April 8. In 1887, following graduation from Stevens Institute of Technology, Mr Erben entered the employ of the Edison Machine Works in Schenectady, forerunner of General Electric. Born in New York City in 1866, he spent most of his life in Schenectady.

Ralph W Kramer, for the past 14 years a plant engineer with the Lynn (Mass.) **Gas & Electric Co,** died recently.

IT'S THE NUT THAT LICKS FASTENING PROBLEMS

THINK of the tough jobs for nuts on planes, tanks, guns, naval vessels and production equipment.

And it's in these jobs you'll find Elastic Stop Nuts.

In fact, you'll find more of them than all other lock nuts combined.

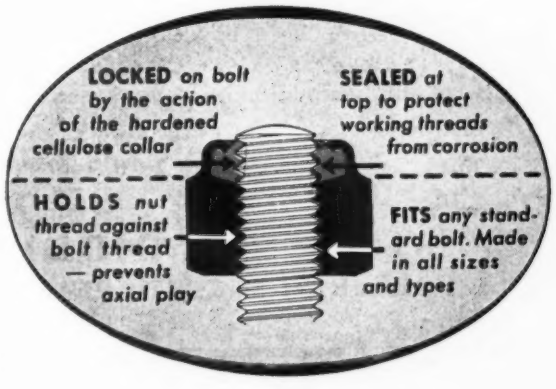
The reason is, these nuts stay put.

Once on, they're set – don't shake loose even under severe vibration. And you can take them off and put them on many times and they won't lose their locking ability.

When peace returns, they're going to solve all kinds of manufacturing problems. They're going to relieve maintenance engineers of frequent inspections and *save time and money in replacements.*

Our engineers have been solving fastening problems for years – the stickers of both peace and war.

Whenever you have a fastening detail to be met, feel free to call upon us. We'll gladly share our experience and recommend the right Elastic Stop Nut.


LOCKED on bolt by the action of the hardened cellulose collar
SEALED at top to protect working threads from corrosion
HOLDS nut thread against bolt thread — prevents axial play
FITS any standard bolt. Made in all sizes and types

ELASTIC STOP NUTS

Lock fast to make things last

ELASTIC STOP NUT CORPORATION OF AMERICA
UNION, NEW JERSEY

ESNA TRADE MARK

The new U.S.-made "Megger" Insulation Tester in molded plastic case. Ask for Bulletin 1735-W.

THE "MEGGER" TESTER IS ALWAYS READY

When the need arises for emergency insulation testing of electrical equipment—it calls for immediate and positive action. "Megger" Insulation Testers are *always* ready for use, day or night, even in the most remote, isolated, inaccessible locations. The self-contained hand-cranked generator is a source of power that is reliable and wholly independent of any battery or other outside source. The "Megger" Tester is a complete unit in itself.

For occasional use, for periodic tests and for emergency tests, your "Megger" Tester is *always ready.* If you do not have full information on how to use and operate "Megger" instruments, write for a free copy of the Pocket Manual of "Megger" Practice, No. 1420-P.

JAMES G. BIDDLE CO.
1211-13 ARCH STREET • PHILADELPHIA, PA.

"MEGGER"
TRADE MARK REGISTERED U.S. PAT. OFF.
Insulation Testers, Ground Testers and Ohmmeters

Horace E Shedd, 78, retired safety director for the **Appalachian Electric Power Co,** Kentucky and West Virginia Power Co, and the Kingsport Utilities Co, died March 18. Mr Shedd retired from active service with the Power Co on Sept 1, 1942, after spending 30 years with the Appalachian Electric Power Co.

o o o

At the 17th annual meeting of the **Industrial Unit Heater Association,** held in Detroit, March 10, the following officers were elected for the ensuing year: **C E Scott,** president; **E W Petersen,** vice-president, and **L O Monroe,** secretary-treasurer.

Easier to read because of shaded guide lines, **new psychrometric chart,** published by **General Electric Co,** speeds up reading of horizontal lines without a straight edge. Copies may be obtained from **Manual Service Section, General Electric Co, Bloomfield, N. J.** at $1.50 per hundred.

Cummins Engine Co announces several changes in executive personnel: **V E McMullen** succeeds **J I Miller** as vice-president and general manager, Mr Miller having resigned to accept a commission of lieutenant in the U. S. Naval Reserve; **Carl R Fox** advances from position of assistant works manager to works manager. Other changes find **J D Allen** elevated to post of assistant sales manager, and **K M Leech** promoted to assistant service manager.

Joshua Hendy Iron Works announce completion of first marine turbine to be built on the Pacific Coast. Built to specifications for C-1 cargo vessels, this turbine develops 4000 shaft hp, operating at 440 psi. 750 F. . . . A new company has been formed by F W Farris, former general manager of Kieley & Mueller, Inc. The new company, **Farris Engineering Co,** is now manufacturing equipment for the Navy, Maritime Commission and other groups assisting in the war effort. Among products manufactured are, pressure-reducing valves, high-pressure valves, strainers, steam separators and filtering devices.

Edward Bouvier has been appointed engineer-operator at the Main St plant of the New England Power System in Webster, Mass. . . . **Magnus Chemical Co,** Garwood, N. J. announces appointment of J D Holmes as manager of the newly organized feedwater treatment

CHECKING ALIGNMENT IN OUR SHOPS

TO SAVE YOUR TIME IN ERECTION

Misalignment and dimensional variation in piping subassemblies delivered to the job can cause considerable trouble and expense . . . and much lost time in field erection. It is a nuisance you need not tolerate.

Midwest takes no chances in this important matter. Every pre-fabricated subassembly is checked for dimension and alignment with utmost care. Any inaccuracies which this check discloses are corrected before shipment is permitted. As a result, Midwest Pre-Fabricated Piping is erected easily and rapidly.

Other time-saving and trouble-saving advantages of Piping by Midwest are the thorough cleaning to remove all scale, dirt, etc. before shipment . . . and the most careful inspection and shop testing.

* * *

Midwest Piping Service can be used to advantage whenever you need piping . . . whether a simple pipe bend or a complex high pressure piping job. Three modern fabricating plants are strategically located to serve you . . . and an experienced Erecting Division will take full responsibility for a complete piping installation.

MIDWEST

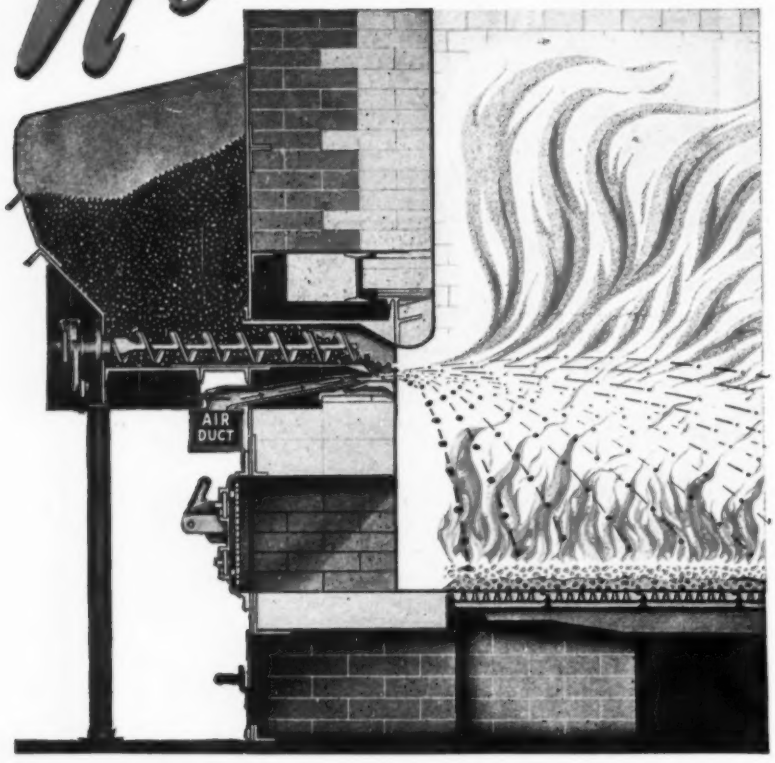
MIDWEST PIPING & SUPPLY CO., Inc.

Main Office: 1450 South Second St., St. Louis, Mo.

Plants: St. Louis, Passaic (N. J.) and Los Angeles

Sales Offices: Chicago—645 Marquette Bldg. • Houston—229 Shell Bldg. • Los Angeles—520 Anderson St. • New York—(Eastern Division 30) Church St. • Tulsa—533 Mayo Bldg.

Now IS THE TIME



TO THINK ABOUT
NEXT WINTER'S STEAM!

IF you are burning oil, present reports indicate that the sooner you change over to coal the better. If you are burning coal, you want best possible results and you'll be better fixed if you can burn local coals or cheap coals. In either case NOW is the time to plan on installing FYR-FEEDER Multiple Spreader Stokers. You'll get delivery in time, installation in time and can select your coal in time.

FYR-FEEDERS burn coal like oil, burn *any* coal, produce steam quicker, increase boiler capacity, are easy to operate. Get all the facts NOW.

FYR-FEEDER
MULTIPLE SPREADER STOKERS

Write for Catalog
Describes FYR-FEEDER operating principles and exclusive design features. Shows typical installations, write today.

AMERICAN COAL BURNER COMPANY
ENGINEERS • ESTABLISHED 1918
Builders of thousands of industrial Stokers

32-18 E. Erie St. **Chicago, Illinois**

CURRENT ARMY E NAVY AWARDS

Carrier Corp. Three-star award presented March 4, 1943.

Midwest Piping & Supply Co. Award presented St. Louis Works April 16, 1943.

Farrel-Birmingham Co. Two-star award presented recently.

Electric Storage Battery Co. Two-star award made recently.

Storage Battery Division, Philco Corp. One-star award made recently.

Foote Bros Gear & Machine Corp. Award presented March 27, 1943.

Elliott Co, Ridgway. Award presented March 30.

Johns-Manville Co. Award presented March 24.

Clarks Bros Co. Award presented March 27.

Wm Powell Co. Award presented recently.

La-Plant-Choate Mfg Co. Award presented March 10.

Westinghouse District Mfg & Repair Plant. One-star award presented recently.

American Foundry Equipment Co. Award presented April 16.

Union Metal Mfg Co. Award presented April 9.

Sarco Co, Inc. Bethlehem plant award made April 22.

Cutler-Hammer, Inc. Award made to all five plants March 26.

Trill Indicator Co. Maritime "M" award presented April 9.

Manning, Maxwell & Moore, Inc. Award presented Bridgeport and Boston plants April 19 and 20.

---

division. . . . **A B Openshaw** has been appointed manager of the Chicago district sales office of **Combustion Engineering Co, Inc,** succeeding James D Harrison, recently deceased.

Walter J Dreves has been appointed vice-president and controller of the **Elastic Stop Nut Corp,** Union, N. J. Mr Dreves was formerly associated with Sears, Roebuck & Co, Chicago, and with Marshall Field & Co. . . . **R J "Chief" Bender,** for the past eleven years combustion engineer for the Sinclair Refining Co in Chicago,

Here at last . . . the answer to Corrosion Problems

ANTI-CORRODE

New Liquid Safeguard Developed by Cities Service

Anti-Corrode, Proved Perfect by Months of Laboratory Testing, Meets Severest Corrosion Requirements. It's Easy, Economical to Apply.

After months of laboratory research and rigorous service tests, Cities Service takes pride in announcing the development of a new and *completely effective* corrosion preventive—Anti-Corrode.

This new liquid safeguard, by virtue of its special properties, and its reasonable cost, is hailed by many engineers as a perfect answer to the vital problem of metal conservation that American industry faces today.

METHODS OF APPLICATION

Anti-Corrode can be applied to raw stocks, finished parts, or to complete machines during storage, assembling or shipping. It is easily applied by dipping, brushing, rubbing, hand or power spraying—and provides a safe film which does not harden, become brittle or crack.

WEATHERING

Anti-Corrode is not affected by rain, salt air, oxygen bearing moisture, etc.

ODOR

Anti-Corrode has no disagreeable odor.

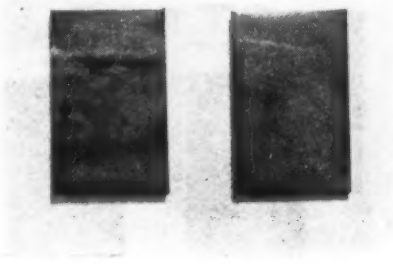
CHEMICALLY INERT

Anti-Corrode is chemically inert to ferrous or non-ferrous metals. Therefore, it can cause no injury to any metal to which it is applied or with which it may be brought in contact.

FINGER STAINS

Surfaces coated with Anti-Corrode can be handled freely without danger of rust spots caused by hand acid.

ANTI-CORRODE MEETS U. S. NAVY TEST



BOTH STRIPS of freshly ground steel pictured here were immersed for 20 hours in a 3% salt solution. Strip on left was untreated; strip on right, coated with Anti-Corrode, shows no trace of rust. (Even after 90 hours of immersion Anti-Corrode coating still resisted rust.)

A LUBRICANT, TOO

Anti-Corrode is compatible with drawing compounds; there is no need to remove it from metal about to be drawn, stamped or otherwise formed.

IDEAL FOR MANY USES

Anti-Corrode can be used on almost every kind of metal or metal equipment—*indoors or outdoors*. Fencing, piping, tubing, wire, wire mesh, girders, sheet metal, metal stock, machinery, trucks, spare automotive parts, tools, metal containers—all need the protection of this new corrosion preventive.

ECONOMICAL

In accordance with regular U. S. Navy Test procedure, Anti-Corrode proved far superior to other leading anti-rust compounds costing as much as *25% to 40% more per gallon.*

Whatever metal equipment you may have, you owe it to yourself to investigate the money-saving advantages of Cities Service Anti-Corrode. (One gallon of Anti-Corrode protects approximately 1200 square feet of sheet metal.) Send the coupon below for further information on how to obtain an adequate sample of Anti-Corrode FREE.

CITIES SERVICE OIL COMPANY
Room 1628
Sixty Wall Tower, New York.

Gentlemen: I'd like to test Anti-Corrode on my own equipment FREE OF CHARGE. Send me the details.

Name .....

Title .....

Company .....

Address .....

OIL IS AMMUNITION—USE IT WISELY!

CITIES SERVICE OIL COMPANY
NEW YORK • CHICAGO

IN THE SOUTH
ARKANSAS FUEL OIL COMPANY
SHREVEPORT, LA.

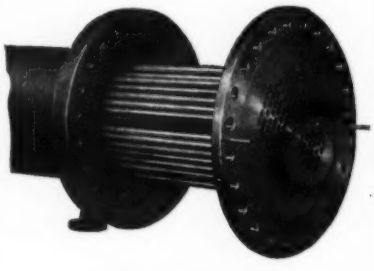
We have the spare capacity to go into immediate production on any special heat exchanger you may need. Construction can be of any type of material specified—for all types of liquids. Transfer of heat from liquid to liquid or steam to liquid, etc. Diameters up to 30"; pressures up to 600 p.s.i.

Take advantage of this opportunity to get the heat exchanger you need. There are Henszey Company representatives in 32 leading cities listed under our name in the local telephone directory. Get in touch with any of them, or write, telegraph or telephone direct to Watertown.

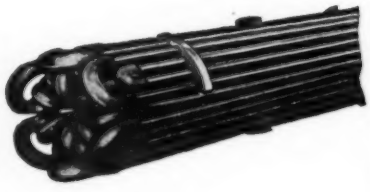
HENSZEY COMPANY
Dept. D6, Watertown, Wis.

HENSZEY

HENSZEY
HEAT EXCHANGERS



Tube Sheet End of Exchanger



Return Tube Exchanger

CONTINUOUS BLOWDOWN SYSTEMS

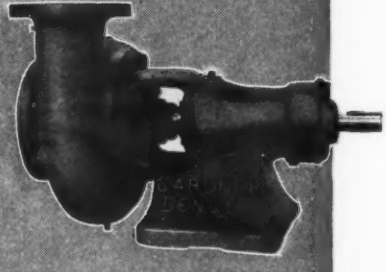
Boiler Feed Regulators ● **Feed Water Meters**
Proportioning Valves ● **Flow Indicators**

Ill., and editor of the monthly Sinclair *Firebox*, has joined the Navy Reserves as Lieutenant. . . . **Dr Frank K Schoenfeld** has been named technical superintendent of the chemical division of the **B F Goodrich Co.** In his new post he succeeds **Dr Robert V Yohe**, recently named manager of the Kentucky synthetic rubber plant operated by the company for the government.

Charles D Wettach and **John R McCune, Jr**, have been elected to the Board of Directors of the **Sterling Varnish Co**, Haysville, Pa. Mr Wettach is past president of the National Paint, Oil and Varnish Association of the United States, while Mr McCune is president of the Consolidated Lamp and Glass Co, Coraopolis, Pa. . . . **Harry K Smyth** has been appointed general manager of the Edwards Co, Sanford, N. C., division of the Rogers Diesel and Aircraft Corp.

Norman F Smith, vice-president and general manager of the **Osborn Mfg Co**, was elected president of the **American Brush Manufacturers Association** at the 26th annual convention of that organization. . . . **Al Campbell**, formerly of **Manning, Maxwell & Moore, Inc**, of Bridgeport, Conn., has become associated as sales manager with **Kieley & Mueller, Inc**, North Bergen, N. J. . . . **Henry A Christy**, formerly superintendent, has been named works manager of the **C O Bartlett & Snow Co**, Cleveland, Ohio, succeeding C J Neville, now vice-president and treasurer. Mr Christy joined Bartlett & Snow as production clerk in 1923. . . . **Keith Powlison** has been appointed as president and controller of the **Armstrong Cork Co**, Lancaster, Pa. Mr Powlison joined the Armstrong Cork Co in 1922 as a member of the sales organization of the floor division. After a short absence he returned to Armstrong in 1932 and in 1938 was elected treasurer.

Chain Belt Co announces the appointment of **William W Klemme** as district manager of industrial sales in Dallas, Texas. . . . **Greene, Tweed & Co**, 4377 Bronx Blvd, New York, announces the appointment of **J J McIntosh** as Southeastern sales representative, and **B F Coombs** as Texas sales representative. . . . **The H K Ferguson Co**, industrial engineers and builders, commemorates its 25th anniversary this year. The Ferguson Co was founded in 1918 and was one of the first organizations in the United States to offer "a complete industrial service," consisting of designing, building and equipping plants and factories ready for operation.



TODAY—when all wartime equipment is giving its utmost—Gardner-Denver Centrifugal Pumps are proving the worth of their advanced design—are delivering extra gallons at lower power cost. And the wartime records of these truly modern centrifugal pumps are writing a tip for tomorrow's pump installations—when extra pumping efficiency will be equally in demand.

GARDNER-DENVER

Since 1859

FOR LARGE CAPACITIES AND HEADS UP TO 350 FEET—*Gardner-Denver Horizontally Split Case, Double-Suction Centrifugal Pumps are ruggedly constructed for heavy-duty service. Large, smooth waterways prevent eddies and cross currents. Horizontally split casings permit easy access to rotating element without disturbing pipe connections.*

COMPACTNESS AND SIMPLICITY OF DESIGN—*The shaft, impeller and bearings are the only moving parts of Gardner-Denver Side-Suction Centrifugal Pumps. Efficiently designed water channels and impeller blade angles. Designed for low-cost, general utility service—built in capacities from 5 to 1600 gallons per minute.*

COMPLETELY ASSEMBLED AND READY FOR USE—*Gardner-Denver Close-Coupled Centrifugal Pumps are assembled as a compact unit that may be installed in any position on the floor, wall or ceiling. Water passages and impeller blades are carefully proportioned and thoroughly tested. Built in capacities from 30 to 1200 gallons per minute.*

HANDLES PULP OR SOLIDS IN SUSPENSION—*Gardner-Denver Horizontal Non-Clogging Centrifugal Pumps are designed for waste disposal and for handling any fluid containing solids or stringy substances in suspension. Designed with accurate impeller blades and casing passages—may be easily adapted to fit special applications.*

For complete specifications, write Gardner-Denver Company, Quincy, Illinois

• SAFETY & RELIEF VALVES • PRESSURE & VACUUM GAUGES • SPECIALTIES

PRECISION-built? Sure they are! Correctly designed? Yes, sir! Constructed from finest, carefully selected materials? Every part! But, this is what really is important to you: Every Lonergan gauge indicates pressures accurately on a clear, easy-reading dial...and retains its high initial accuracy even under violent pulsations! That's why Lonergan gauges are standard in many plants.

J. E. LONERGAN CO.
Race & 2nd Sts., Phila., Pa.

Lonergan

SIGN OF PROGRESSIVE ENGINEERING!

SINCE 1872

SAFETY & RELIEF VALVES • PRESSURE & VACUUM GAUGES • SPECIALTIES •

New DEVELOPMENTS BY FREDERICK ADD NEW THRIFT and CONVENIENCE TO INDUSTRIAL STOKER OPERATION

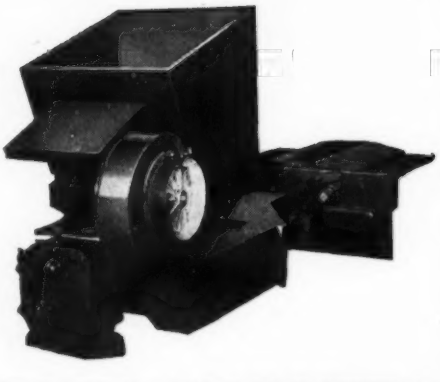
• FULL ACTIVE GRATE SURFACE . . . that's one new Frederick advantage! There's more grate area; no dead plates—whether furnished with or without side dumping grates.

• IMPROVED TUYERES are designed with air ports so arranged and proportioned as to insure thorough air distribution and maximum combustion efficiency.

• TUYERES ARE LOCKED IN PLACE so they cannot be raked up inadvertently.

• COMPLETELY ENCLOSED WINDBOX simplifies and makes a neater installation; eliminates danger of efficiency loss through leaky brickwork.

• TWO CLEAN-OUT DOORS give easy access to *both* sides of the undergrate area to facilitate cleaning.



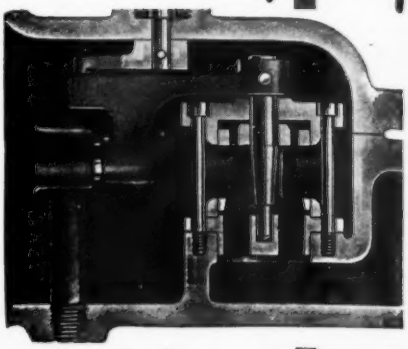
. . . *All these features, and many more, are Frederick innovations engineered to give you more for your stoker dollar than has been available ever before. A complete description of these features is in our new Stoker Bulletin. Ask for your free copy. You'll find it's interesting reading.*

FREDERICK STOKERS

The FREDERICK IRON & STEEL CO.
Frederick, Maryland

COMPLETE LINE OF CENTRIFUGAL PUMPS FOR ALL PURPOSES
STEAM OPERATED ASH CONVEYING SYSTEMS - ASH STORAGE BINS

The Secret of this Drainers Great Capacity



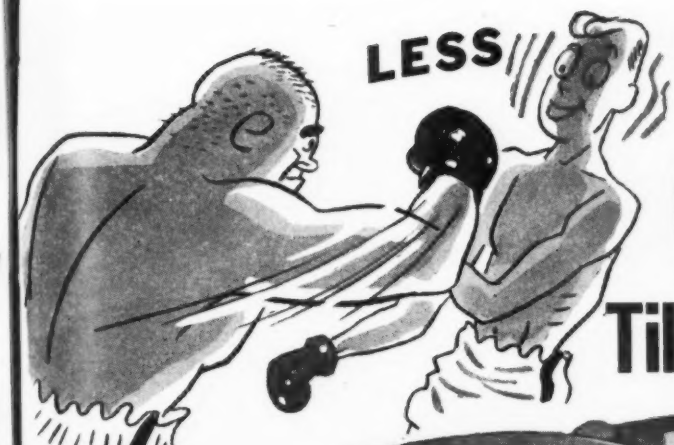
The Cochrane Balanced Rotary Multiport Valve

COCHRANE DRAINERS are famous among power plant operators for their tremendous discharge capacity. Wherever large quantities of condensate must be continuously removed as from evaporators, heaters, separators, coils or steam lines, under vacuum or positive pressures, Cochrane Drainers are specified by experienced plant men. The secret lies in their multiport valve construction, a series of longitudinal parts in the rotary valve matching similar parts in the stationary valve sleeve. The height of the condensate in the drainer body thus automatically determines the rate of discharge.

Write for a copy of Publication 2925

COCHRANE CORPORATION
3708 N. 17th St., Philadelphia, Pa.

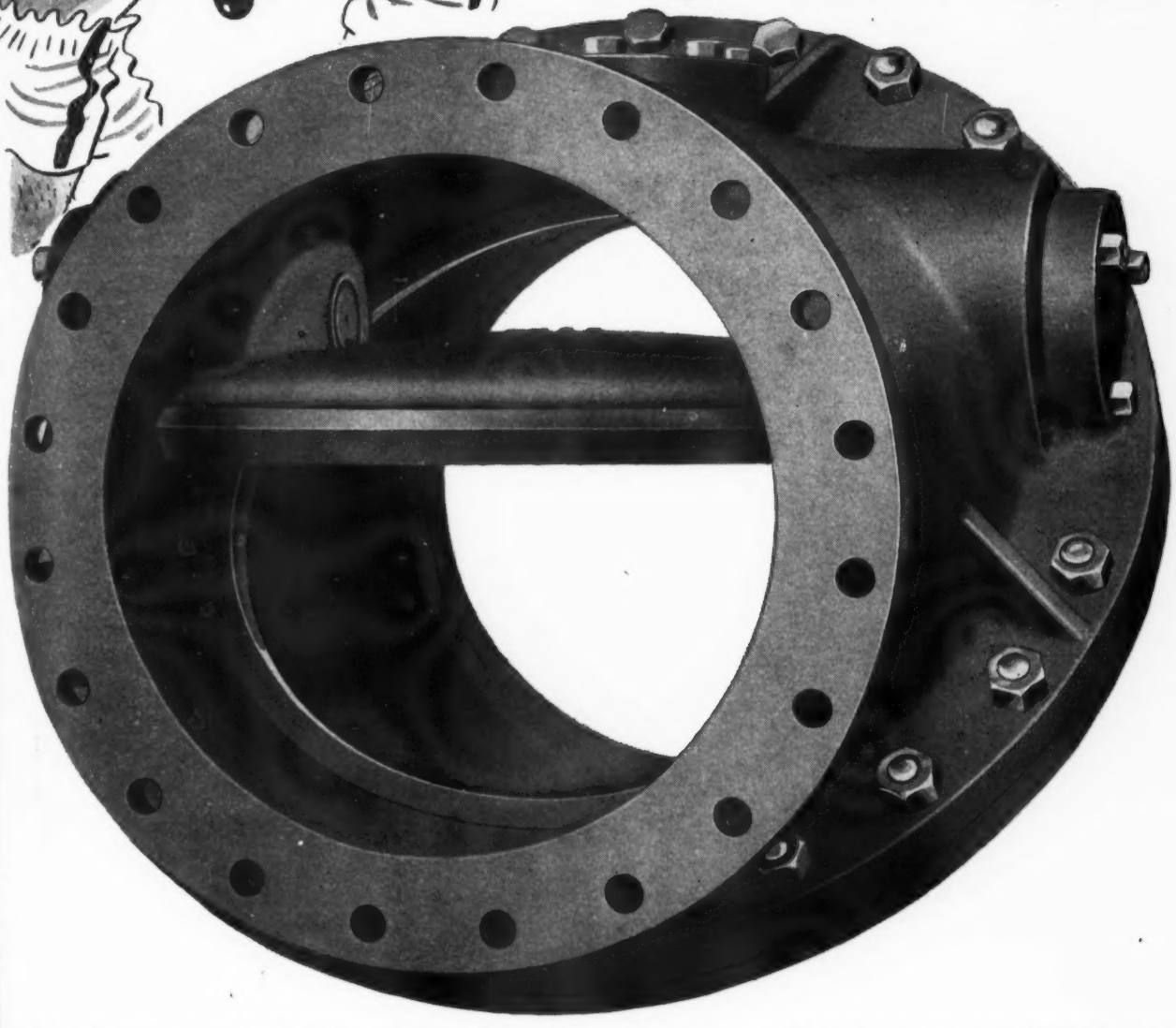
COCHRANE
STEAM SPECIALTIES



LESS LOSS OF HEAD WITH

CHAPMAN'S

Tilting-Disc Check Valves

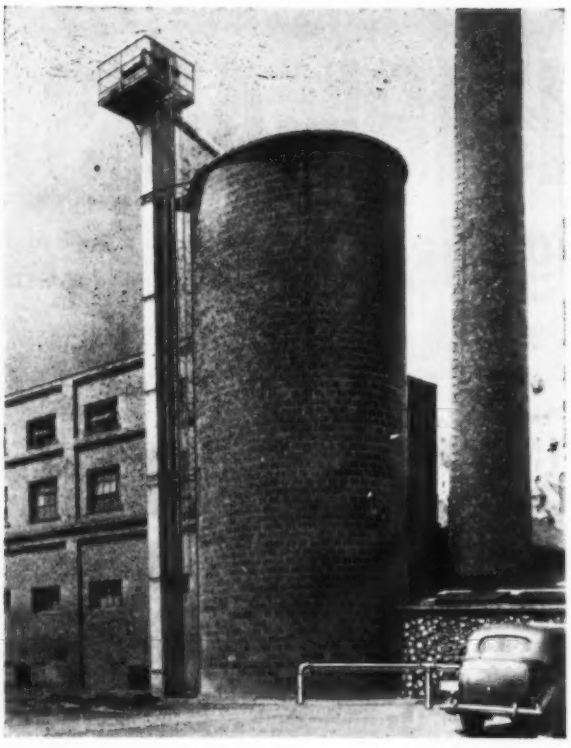


Head loss is cut 65% to 80% by this exclusive Chapman design. For most of the weight of the tilting disc is carried on the hinge-pins, so that it is readily held in the open position . . . and the airfoil design of the disc offers minimum resistance to flow. Also, the streamlined body contains no obstructions, and the net area through the valve is equal to the area of the pipe.

What's more, this valve causes no vibration, surging, hammering, or opening of pipe joints . . . *because the disc can't slam.* Cushioned closing eases the disc silently to a drop-tight seat under all pressures. If you want to get free *and stay free* from all usual check-valve troubles, get in touch with The Chapman Valve Mfg. Co., Indian Orchard, Mass.

CHAPMAN NON-SLAM CUSHIONED CLOSING **CHECK VALVES**

FUEL OIL HAS GONE TO WAR



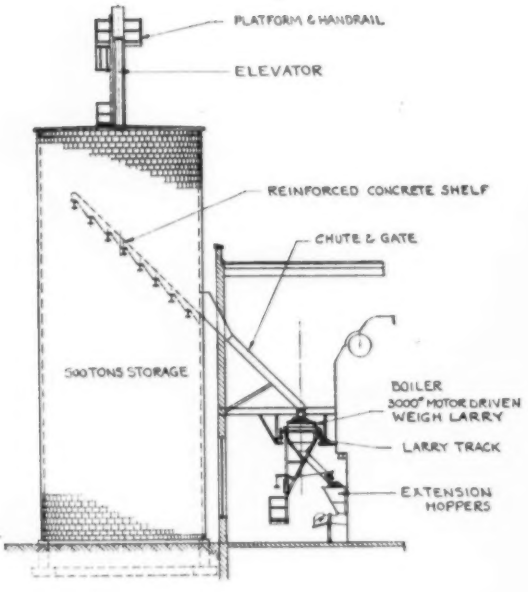
CONVERSION TO COAL REQUIRES NO CHANGES TO EXISTING STRUCTURES

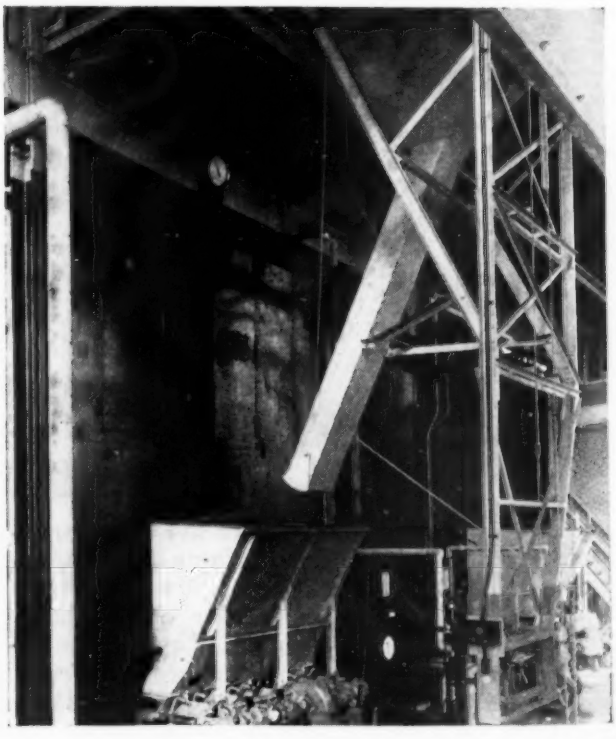
● The job of changing over to coal may look like an impossible problem to you. You may think the cost of mechanical handling is out of your range of possibilities. Our constant activity in the conversion movement for the past year may be of help to you. Perhaps the answer to your problem, like many others is

The FAIRFIELD SILO SYSTEM

If you think that conversion will require costly changes to your present buildings—we can set your mind at ease on this point—there are no changes necessary.

The Silo constructed of vitrified tile, a non critical war material, resists moisture, makes a pleasing appearance and is kept clean by the rain. Minimum of ground space is required to store up to 1,000 tons of coal. The silos are usually filled by a bucket elevator. The means of conveying coal to stokers or pulverizers is either by weigh larry or conveyor.





Fairfield will handle the entire installation from erection of Silo to complete handling of coal to storage and from storage to stokers.

Our catalog illustrates and fully describes a host of successful installations. Write for your copy today.

THE FAIRFIELD ENGINEERING CO.- MARION, OHIO
BUILDERS OF COAL AND ASH HANDLING EQUIPMENT

YOU PILE UP IMPORTANT ADVANTAGES

When You Use

B-H MONO-BLOCK INSULATION

Here is the ideal insulation for boilers, turbines, engines, ovens, furnaces and other high temperature installations all the way up to 1600° F. No other insulation gives you all these important advantages:

HIGH TEMPERATURE PERFORMANCE

Made from special *black* rock-wool, MONO-BLOCK refuses to break down under much greater heat than many other types of insulation can stand.

MOISTURE RESISTANCE

This same special *black* rock-wool makes possible a block which is highly resistant to moisture and does not disintegrate. You are assured of permanence of physical properties and retention of high insulating values even though MONO-BLOCK is exposed to humid conditions.

WIDER SERVICE RANGE

As its name indicates, MONO-BLOCK eliminates the necessity for one type of block for temperatures up to 600° F. and another type for temperatures above 600° F. MONO-BLOCK does the job for both.

LOW CONDUCTIVITY

Exceptionally low conductivity is another MONO-BLOCK characteristic that pays big dividends. This is made possible through an exclusive, patented felting process, which produces a low density block.

EASY TO INSTALL

Sufficiently rigid to support its own weight and yet yielding enough to absorb surface irregularities, MONO-BLOCK produces a neat, snug job with little effort. B-H BOND-TITE adhesive simplifies the application of the block.

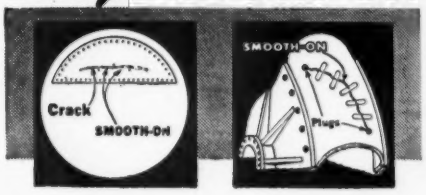
Check for yourself these practical advantages. Send for generous samples of B-H MONO-BLOCK and B-H BOND-TITE Cement. Just write us on your regular letterhead. Do it now.

BALDWIN-HILL *Insulations*

575 KLAGG AVE. TRENTON, N. J.

NEW YORK CHICAGO KALAMAZOO

Impossible to Repair? ...try SMOOTH-ON

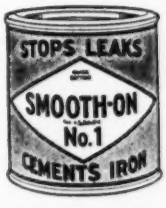


We continually receive reports from plant engineers and maintenance men that SMOOTH-ON No. 1 has enabled them to make successful repairs on unreplaceable apparatus after welding and other methods had failed.

Cracks in water jackets of engines or in steam jackets of process apparatus . . . breaks in castings, heads or flanges of pumps, compressors, condensers, evaporators . . . leaks at seams, rivets, pipe connections, slip joints, cylinder liners . . . corroded, worn, or porous spots in metal tanks and other pressure vessels . . . these are some of the repairs that can be made speedily, effectively, permanently with SMOOTH-ON, without the use of heat or dismantling of apparatus.

With a can of SMOOTH-ON handy, you will be prepared for instant action when leaks and breaks threaten production delays. Don't wait for the emergency, buy a can of SMOOTH-ON today.

Get Smooth-On No. 1 in 7-oz., 1-lb., 5-lb., 25-lb. or 100-lb. containers from your dealer, or if necessary from us. For your protection, insist on SMOOTH-ON, used by engineers and repair men since 1895.



FREE

40-Page Handbook

Simple, concise instructions for hundreds of material-saving repairs to plant equipment and pipe lines are given in this 40-page practical repair manual. A war-time necessity in every plant. Your copy sent FREE, if you fill in and return the coupon.

SMOOTH-ON MFG. CO., Dept. 30
570 Communipaw Ave., Jersey City, N. J.

Please send SMOOTH-ON HANDBOOK.

Name.....

Address.....

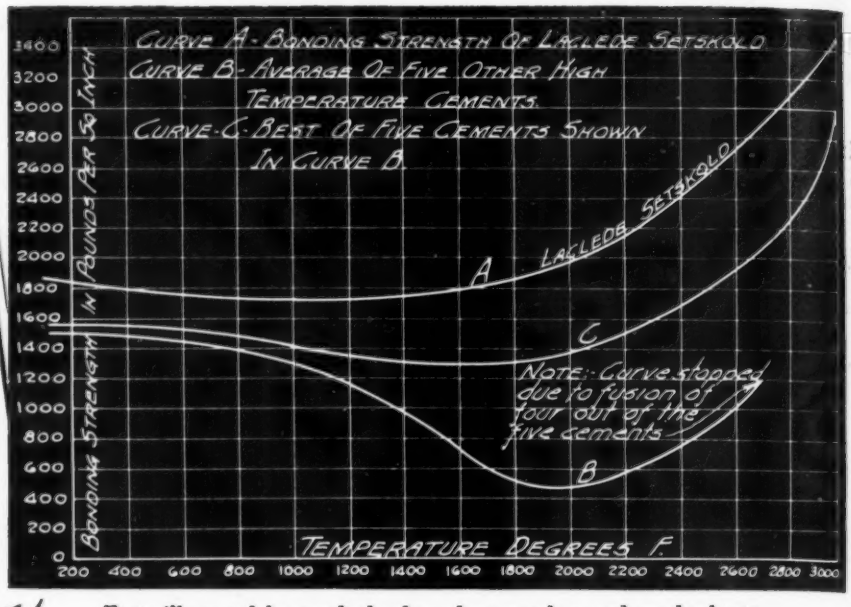
.....

6-43

Do it with SMOOTH-ON

When You Need a Refractory Bonding Mortar With MAXIMUM BONDING STRENGTH

Specify LACLEDE SETSKOLD OR SETSKOLD C-7


CURVE A - BONDING STRENGTH OF LACLEDE SETSKOLD
CURVE B - AVERAGE OF FIVE OTHER HIGH TEMPERATURE CEMENTS.
CURVE C - BEST OF FIVE CEMENTS SHOWN IN CURVE B.
BONDING STRENGTH IN POUNDS PER SQ. INCH
TEMPERATURE DEGREES F.
LACLEDE SETSKOLD
A
B
C
NOTE: Curve stopped due to fusion of four out of the five cements
0 200 400 600 800 1000 1200 1400 1600 1800 2000 2200 2400 2600 2800 3000 3200 3400
200 400 600 800 1000 1200 1400 1600 1800 2000 2200 2400 2600 2800 3000

Facts illustrated by graph clearly and accurately reveal result of tests on five brands of refractory cements as compared with Setskold.

Guard against failures of refractories due to inferior grades of bonding mortar. For a satisfactory job, the mortar is just as important as the brick, so be sure you select the mortar that is best for your job.

When you want a high temperature bonding cement with a bonding quality that makes a solid rock-like wall — that is uniform and dependable — and is noted for its economy of application, ask for Laclede Setskold (diaspore base cement), or Setskold C-7 (Kyanite base super-cement).

Both of these products are resistant to spalling, erosion, slag, and adhesion. Wipe out these enemies of production and save labor, materials, and time. Why take a chance on failure when you can get Setskold or Setskold C-7 from your local dealer or agent. ***Get his name from your local telephone directory or write direct.***

LACLEDE ENGINEERING SERVICE

When you have a problem involving refractories, call in a Laclede-Christy engineer. Because Laclede-Christy offers a *complete* line of refractories, he will give you an unbiased recommendation — the *right* recommendation for your job. Complete blueprints and estimates will be furnished without cost or obligation.

Write for complete details on Setskold and Setskold C-7.

LACLEDE-CHRISTY FOUNDED 1844 ST. LOUIS, U.S.A.

LACLEDE-CHRISTY
CLAY PRODUCTS COMPANY
Ambassador Bldg., St. Louis, Missouri

World's Largest and Most Diversified Line of High Temperature Refractory Specialties

Which trap does what?

If you were confronted with seventeen steam traps from which to select one for your job, would you know which to choose? Whether they were all of one make or seventeen different makes, you would still have a selection problem. But you can solve any steam trap problem by getting a copy of the book "How To Choose A Steam Trap." It tells you what trap to choose and why, and which type and size of trap for your specific purpose—it's filled with facts and figures on steam traps. It's yours on request with the compliments of Anderson's Super-Silvertop Steam Trap.

THE V. D. ANDERSON CO.
1934 West 96th Street • Cleveland, Ohio

Arrests SPARKS and FLAME, Shackles EXPLOSIONS

You don't need dynamite and a detonator to get a first-rate explosion!

Just take some dust-laden air, or air mixed with certain gases, vapors or mists (which may be handy in or around your plant) and touch a spark to them. The result will probably astonish you.

Maybe you can't eliminate certain explosive hazards, but you can choke the sparks that set them off, with Air-Maze spark arresters.

We are making devices for that purpose now. We can engineer special ones if needed. But one way or the other you can end the unnecessary danger of potential explosions.

Air-Maze intake and tank vent flame arresters protect against dust as well as explosions. Air-Maze exhaust spark arresters dissipate heat rapidly, effectively "killing" dangerous sparks.

Complete details on Air-Maze spark and flame arresters are available. Tell us your problems.

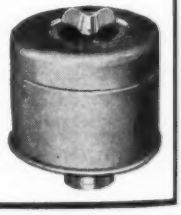
AIR-MAZE EXHAUST SPARK ARRESTERS are easily attached to engine exhaust pipes. Cylindrical elements prevent escape of sparks. Back pressures are not increased, due to low restrictions.

CLEAN AND QUIET INTAKE AIR, GUARD AGAINST EXPLOSIONS

Oil bath filter with integral silencing device. Easily installed and serviced. →

← **Heavy-duty, cleanable filter-silencer. Highly efficient, but without automatic oil-washing action.**

Air-Maze Tank Vent Flame Arrester. Double protection for tanks containing volatile, inflammable liquids. Prevents sparks from igniting—and dirt from contaminating—contents. →



THE AIR-MAZE CORPORATION • CLEVELAND, OHIO

AIR-MAZE

SPECIALISTS IN AIR FILTRATION

For FASTEST DELIVERY ship when ready!

YOU can expedite delivery of your AIR EXPRESS packages and help avoid congestion of vital war shipments by shipping when ready, as early in the day as possible.

This will help us get your shipments on the "earliest plane out" so they will be delivered sooner than if you waited until end of day when airline traffic is at its peak.

And to cut costs—AIR EXPRESS packages should be *packed compactly but securely*—to obtain best ratio of size to weight.

Air Express Speeds War Program

TODAY, AIR EXPRESS not only serves the home front but is also working hand in hand with the Army and Navy to supply our fighting fronts throughout the world.

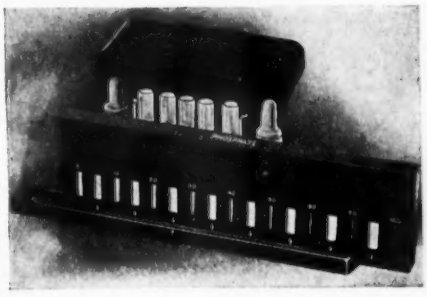
TOMORROW, AIR EXPRESS will girdle the globe in international peacetime commerce . . . to bring *all* foreign markets to the doorstep of American business.

AIR EXPRESS
Gets there FIRST

Phone RAILWAY EXPRESS AGENCY, AIR EXPRESS DIVISION
Representing the AIRLINES of the United States

WRITE for our quick-reference handbook on "How to Ship by AIR EXPRESS During Wartime." Dept. PR-1, Railway Express Agency, 230 Park Avenue, N.Y.C.

SPEED AND



ACCURACY

In Control of Phosphates

Obtaining both speed and accuracy, without sacrificing either, is the accomplishment for which modern and efficient management is striving. Today's industrial problems make it *desirable*—our all-out war effort *demands* it.

The TAYLOR HIGH PHOSPHATE SLIDE COMPARATOR is an invaluable safeguard against delay caused by boiler shutdown. It makes it possible to control the phosphate content of boiler water with utmost accuracy, thus reducing corrosion and scale formation. The range is 5—100 ppm of phosphate as PO_4.

Determinations are made simply by moving the slide in front of the test sample until a color match is obtained, then reading the phosphate content directly from the values engraved on the slide. Permanent and dependable accuracy is assured by TAYLOR'S UNLIMITED GUARANTEE AGAINST FADING of color standards. The price of $18.50—$26.00 in wooden carrying case—makes it a low-cost and indispensable instrument.

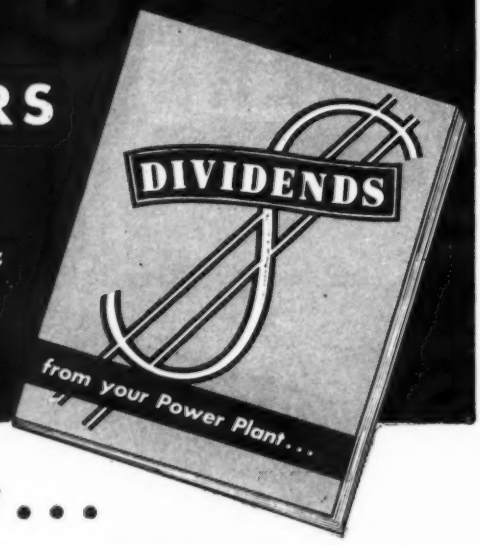
THE TAYLOR LOW PHOSPHATE

Slide Comparator is similar to the Taylor High Phosphate Slide Comparator, except that the range covered is 0-25 ppm. The reagents are the same for both. Price $18.50—$26.00 in carrying case. All prices f.o.b. Baltimore.

• *Write TODAY for free, illustrated booklet—or see your dealer.*

W. A. TAYLOR AND CO.
YORK & ROGERS FORCE RDS. • BALTO, MD.

NEW BOOKLET HELPS ENGINEERS *even if they don't read it*



Here's How . . .

It is written to help engineers in their relations with plant managers. It tells the manager some of the things he ought to know about steam generation, economy-promoting apparatus and the problems of the operating engineer. In some parts it speaks the mind of the engineer in a way that few engineers would care to do face to face with a managing executive. The article on labor costs is one example.

FREE

Send for a copy today. It's free and asking for it does not place you under any obligation whatever. Your request will not subject you to high-pressure selling tactics. This booklet is being distributed as a service to industry and to those who we hope will be our customers when priorities no longer control the placing of business.

PREFERRED UTILITIES COMPANY, INC.
33 West 60th St., New York, N. Y.

PREFERRED UTILITIES — Rigged for Results — ENGINEERS

PREFERRED UTILITIES

MANUFACTURERS OF UNIT STEAM GENERATORS

COUPON FOR YOUR CONVENIENCE

PREFERRED UTILITIES CO., 33 WEST 60th ST., NEW YORK CITY

Name _____

Company Name _____

Address _____

The Problem of the 225 p. p. m.

From ILLCO's Case Book of Boiler Feed-Water Treatment . . .

A LARGE PUBLIC UTILITY needed more equipment. Expansion prompted it to find out if there was a better method of water treatment for its boilers (both low and high pressure type). Previously, it had operated with two older and accepted types of treatment. Various concerns were called in, including the Illinois Water Treatment Company.

A UTILITY'S RAW WATER SUPPLY contained 225 parts per million of dissolved solids, of which 161 p.p.m. were scale-forming. The amount of make-up water required was 32,000 gallons per hour, 24 hours a day.

COMBINATION-REGENERATION equipment was recommended by ILLCO. This consisted of three reactor tanks (9 ft. diameter, 7 ft. high), containing ion-exchange material to be *regenerated simultaneously with salt and acid*—a process pioneered by ILLCO and which has demonstrated its excellence for over five years in leading industrial plants.

PRODUCING THE REQUIRED MAKE-UP of 32,000 gallons per hour of water free from scale-forming solids and having a total dissolved solid content of less than 40 p.p.m., this unit and this method provided the ideal solution.

NOTEWORTHY ADVANTAGES: Lower dissolved solid concentration in the boiler water, therefore fewer blow-downs and a saving of fuel. Less supervision: only attention required is periodic regeneration. Even when raw water supply varies, quality of treated water is maintained. On comparative cost of chemicals alone, equipment will pay for itself in less than four years. Other operating expenses also greatly reduced—less fuel consumption, lowered maintenance, etc.

WITHOUT OBLIGATION we'll gladly make a similar survey of *your* boiler feed-water problem, suggest recommendations, describe our equipment in detail.

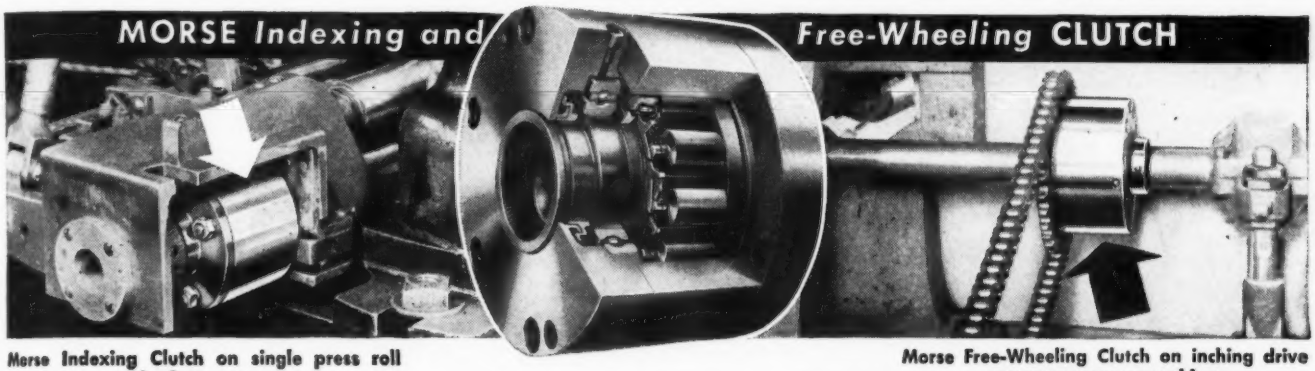
Also engineered and manufactured by ILLCO are De-ionizing Units, Softeners, Filters, Aerators, Chemical Processing Equipment, etc. Write for literature.

TESTED IN THE LABORATORY — ILLCO-WAY — PROVED IN THE FIELD

ILLINOIS WATER TREATMENT CO.
853 Cedar Street, Rockford, Illinois

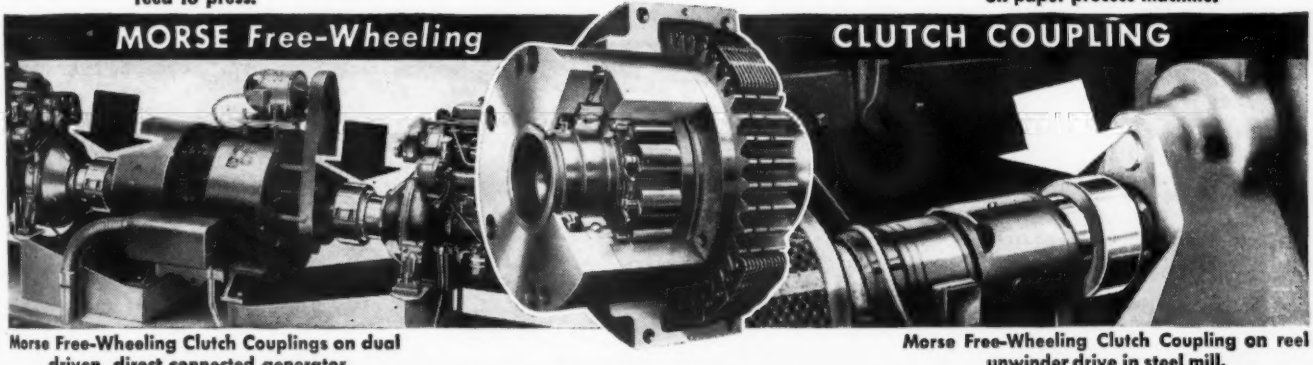
MORSE CLUTCHES
Meet Many Needs

High quality functional clutches designed in a wide range of sizes and capacities for indexing, free-wheeling and backstop service.



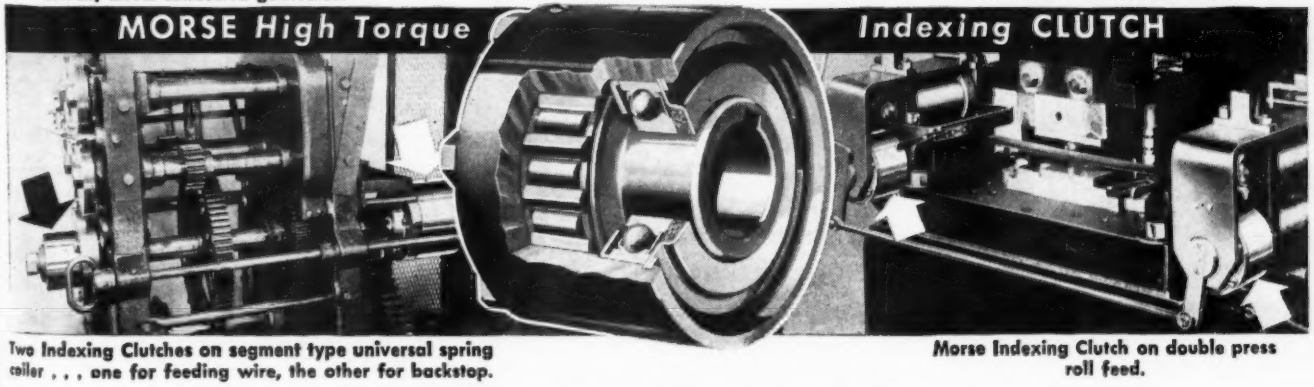
Morse Indexing Clutch on single press roll feed to press.

Morse Free-Wheeling Clutch on inching drive on paper process machine.



Morse Free-Wheeling Clutch Couplings on dual driven, direct connected generator.

Morse Free-Wheeling Clutch Coupling on reel unwinder drive in steel mill.



Two Indexing Clutches on segment type universal spring coiler . . . one for feeding wire, the other for backstop.

Morse Indexing Clutch on double press roll feed.

Morse precision products also include silent and roller chain drives, sprockets, chain couplings, Morflex Couplings, Radial Couplings, Pullmore clutches, automotive time chains and marine drives.

SILENT CHAINS · ROLLER CHAINS · FLEXIBLE COUPLINGS · CLUTCHES

MORSE *positive* DRIVES

MORSE CHAIN COMPANY · ITHACA, N. Y. · DETROIT, MICH. · DIVISION BORG-WARNER CORP.

Let this be your contribution to Victory: Make your heating equipment serve longer by good care . . . Conserve fuel by promptly replacing worn-out or inoperative parts.

Guard your Steam Heating System against excess pressures

Troubles often begin with failure to observe recommended working pressures.

Your steam heating system is worth protecting. Excessive pressures caused by careless boiler firing, incorrectly adjusted or inoperative reducing valves, etc., may cost you money in time, labor and materials. Damaged equipment may be irreplaceable and when it can be replaced uses metal essential in the war effort.

The life of your thermostatic traps and their ability to use steam efficiently depends on proper control of working pressures. Keep *working* pressures within the limit recommended by the manufacturer.*

When excessive pressures or long use make thermostatic traps inoperative, depend on Webster Trap Attachments to secure new trap results. Webster Trap Attachments, including Sylphon Bellows (or Diaphragm) and valve piece, are inserted in old trap bodies without disturbing piping and thus use a minimum of needed metals.

Webster Representatives in principal cities are trained heating specialists whose services are available to help you keep your heating system in first class operating condition. Consult your phone book. Write for booklet, "How Much Steam Waste in Your Heating System".

WARREN WEBSTER & CO., Camden, N. J.
Pioneers of the Vacuum System of Steam Heating
Representatives in principal cities : : Darling Bros., Ltd., Montreal, Canada

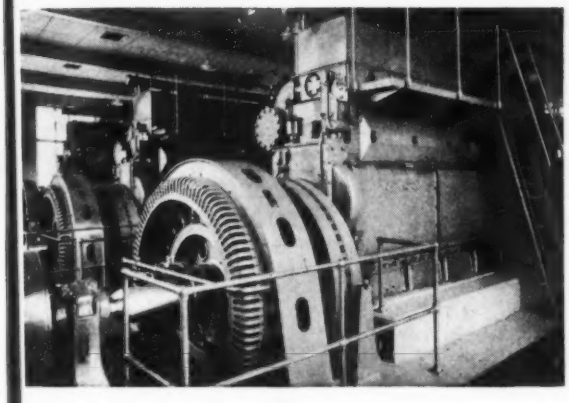
ARMY E NAVY

Webster
Steam Heating

*Recommended *operating* range for Webster Thermostatic Traps is as follows: Sylphon and Series 7 Traps, up to 5 lbs.; Series 7M Trap, up to 15 lbs.; Series 78 Trap, Cl. 2, 15 to 60 lbs.; Series 78 Trap, Cl. 3, 60 to 150 lbs.

Illustrated at right is the Webster "Old Ironsides" war-time radiator trap.

Here's a Pattern FOR COMMUNITY POWER



DIESEL ENGINES 150 to 1500 hp.

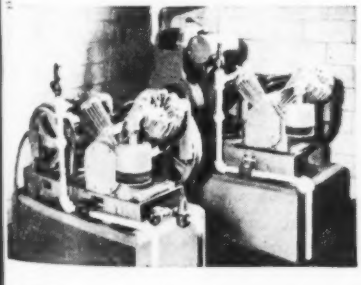
GAS ENGINES 175 to 2880 hp.

CONVERTIBLE GAS-DIESEL ENGINES 150 to 1500 hp.

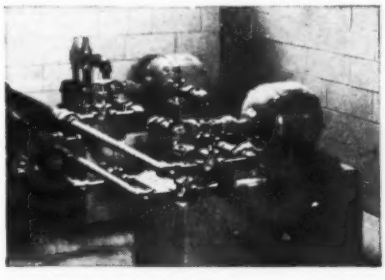
An interesting example of rural community power planning, in cooperation with the Rural Electrification Administration, is the recently completed plant of the Western Michigan Electric Cooperative.

Here three Worthington 595-horsepower fully-enclosed diesel engines, driving synchronous generators, furnish economical power to nearly 1200 consumer-members on 340 miles of line. With its integrated Worthington auxiliary equipment as an assurance of uninterrupted operation, this station is regarded as a model of completeness and advanced methods. Now doing its part in providing power for war services, it stands ready to meet the expanded post-war needs of a forward-looking community. No section of the country is too remote for this kind of modernization.

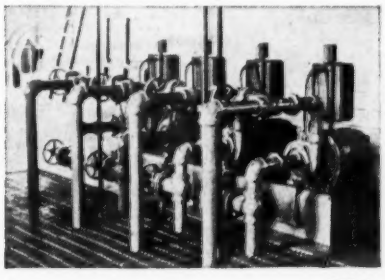
Air compressors for starting



Rotary pumps for fuel oil transfer



Centrifugal pumps for jacket water circulation

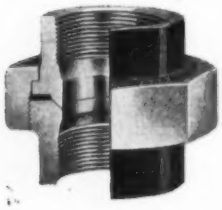


DE3-4

WORTHINGTON

WORTHINGTON PUMP AND MACHINERY CORPORATION • HARRISON, NEW JERSEY

Costs you less per union per year of service



"PETRO" UNIONS

INTEGRAL STEEL SEATS
BALL TO 45° CONE

WORKING PRESSURE, POUNDS PER SQ. INCH

Black or Udylited	STEAM OR HOT OIL			COLD WATER, OIL OR GAS, NON-SHOCK
	500° F	750° F	850° F	
	1150 lbs.	830 lbs.	630 lbs.	2000 lbs.

★ PETRO FORGED STEEL Unions cost you less per union per year of service because of these extra features found only in PETRO forged steel unions.

EXTRA HEAVY ENDS and NUT, PERMANENTLY LUBRICATED and RUST-PROOFED NUT THREADS, MACHINED AND COLD ROLLED SEATS, PLUS 30 YEARS' EXPERIENCE IN THE DEVELOPMENT AND MANUFACTURE OF FORGED STEEL UNIONS.

PETRO Unions have a safety factor against rated working pressures of approximately 5 to 1. Therefore, you can be sure with PETRO.

Let PETRO, HYPDRO and MARK—the three gallant guys of steel-work out your union troubles. PETRO, HYDRO and MARK Unions conform to A.A.R. standards. If you are doing essential war work, order by TRADE NAME from your jobber.

•

Clayton MARK & Company
EVANSTON, ILLINOIS
Originators and Pioneers of Steel Unions Since 1912

For EFFICIENT DIESEL ENGINE OPERATION

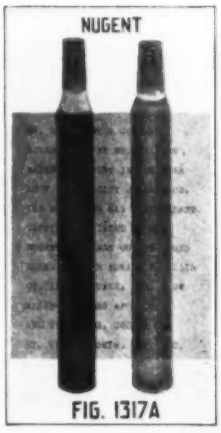
use NUGENT FILTERS

Clean oil can add hours to the life of Diesel engines, reduce maintenance costs and help increase engine efficiency. One proved method of providing *dirt-free* oil for Diesel engines is the use of Nugent Filters.

Nugent Absorbent Type Fuel and Lubricating Oil Filters are being used on Diesel locomotives in stationary engine plants, cement mills, rubber mills, steel mills, etc. These filters are available in a wide range of sizes for Diesel engines from 1 to several thousand H.P. in single containers.

The improved Nugent Depth Type Pressure Filter shown above is equipped with four filter cartridges in a single container. All cartridges are alike and interchangeable regardless of whether they are the Re-packable type or the Re-placeable (throw away) type. Both types are made for capacities from one up to 2248 H.P. in single containers or shells. (Navy Specifications).

Shown above is the style cartridge used in the Nugent Depth Type Pressure Filter. The new Nugent replaceable "Throw Away" Absorbent Filter Recharge may be used in this cartridge. This new recharge is inserted into the filter cage instead of hand packing loose waste. It absorbs four times its own weight of water, dirt and other impurities, yet it does not remove additives embodied in the oils.



HERE'S THE WAY LUBE OIL LOOKS BEFORE and AFTER PASSING THROUGH A NUGENT FILTER

Before: Shown at the left is a sample of dirty crankcase oil taken from a 300 H.P. gas engine before installing a Nugent Filter.

After: At the right is a sample of oil from the same engine *after* installing Nugent Filter, and operating 1,344 hours before cleaning filter.

WM. W. NUGENT & CO., INC.
Est. 1897
402 N. Hermitage Ave. Chicago, Illinois

Electroweld Steel Tubing

SAVES WEIGHT AND MEETS YOUR SPECIFICATIONS

Used where performance factors are vital

When there's an extra premium upon increased as well as sustained production, specification accuracy which is dependably maintained becomes of ever increasing importance to you. The solution to that need is found in Electroweld Steel Tubing. It is lighter in weight without sacrificing strength; hence, forming, cutting, and welding operations become decidedly faster and easier. No other method of tube manufacturing can provide you with such uniform wall thickness. Furthermore, the physical and chemical properties throughout the wall can be provided exactly as specified, thus meeting your most exacting requirements at all times. The excellence of surface and uniformity of diameter provide you with additional production advantages.

These Electroweld benefits are the result of manufacturing tubing of accurate-to-specification strip steel on America's latest and most modern tube mills. Every foot of every length of Electroweld Tubing is hydrostatically tested for safety and meets Government, A.S.M.E., as well as A.S.T.M. specifications. Today we serve the Armed Forces with tubing which has these benefits, and we trust that after the war you will take advantage of Electroweld's outstanding qualities.

Electroweld

SIX ADVANTAGES

- Uniform diameter
- Uniform wall thickness
- Uniform physical properties
- Test-proven welds
- Scale-free, silver-bright finish
- Square cuts, minimum burr

Electroweld STEEL • • OIL CITY, PENNA.

A Division of TALON, INC.

Manufacturers of pressure and mechanical steel tubing

SAVE Time—Labor—Materials

Lay up Furnace Linings with

ADAMANT

FIRE BRICK CEMENT

and keep them in service longer because Adamant makes joints (where breakdowns usually begin) as strong as the brick they bond.

STRONGER BY TEST

Independent laboratory tests prove Adamant has a bonding strength of 800 lbs. per sq. in. at room temperature; 1270 lbs. per sq. in. at 2000° F.

BOTFIELD
REFRACTORIES COMPANY

784 S. Swanson St., Philadelphia, Pa.
In Canada, Canadian Botfield Refractories Co., Ltd., 171 Eastern Avenue, Toronto

Every Ambitious Man in Industry Should Read this Free Booklet!

"FORGING AHEAD IN BUSINESS" contains FACTS for all thoughtful, forward-looking men; it has a message of particular interest to *technical men.*

This 64-page booklet, of which more than 3,000,000 copies have been circulated, outlines a definite plan of training for your future progress in industry.

Said one man who had sent for it:

"In thirty minutes this booklet gave me a clearer picture of my business future than I have ever had before."

Fill in the coupon below and this helpful manual will be sent to you by mail and without cost.

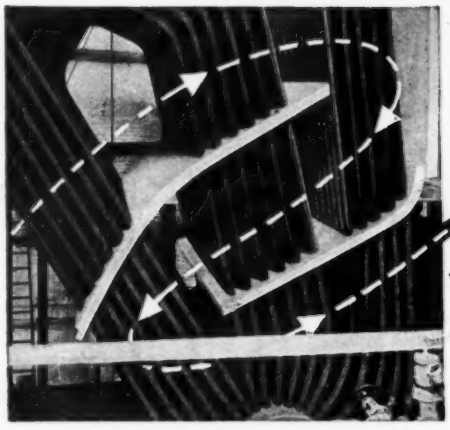
ALEXANDER HAMILTON INSTITUTE,
Dept. 29, 73 West 23rd Street, New York, N. Y.
In Canada, 54 Wellington St., West, Toronto, Ont.

Please mail me a copy of the 64-page book—"FORGING AHEAD IN BUSINESS."

Name.....

Address.....

ENCO BAFFLES



Satisfy Hungry Heating Surfaces

...and many boiler heating-surfaces are literally and unnecessarily starved. They need Enco Baffles to increase heat absorption, to boost efficiency and to increase steam output. Enco Baffles revitalize boilers by providing streamlined cross-flow of gases over the tubes, and by eliminating eddy currents, bottlenecks and dead gas pockets. Bulletin BW40 gives further details. It is yours on request.

THE ENGINEER COMPANY
75 WEST STREET (Enco) NEW YORK, N.Y.

Let CRYER *Prescribe the* TRAP *you need* . . . . . .

As manufacturers of steam specialties for more than 40 years, and as builders of several types of traps for various kinds of service, Cryer is in position to offer unbiased recommendations as to the trap best suited to any specific conditions. If you are having trap troubles or wish advice on traps based on long experience, consult CRYER. Write for detailed information on CRYER TRAPS.

CRYER INVERTED BUCKET STEAM TRAP

This trap is positive in action and quick venting and will not air bind. It provides large capacity, is accessible, easily installed and guaranteed to discharge condensate at rated capacities and to operate satisfactorily within the limits of pressure and capacity.

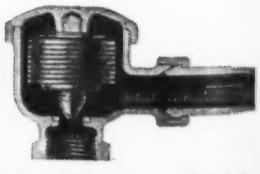
Made in sizes from ½" to 2½"; capacities 500 to 38,000 lbs.; pressures, 1 to 250 lbs.

THE CRYER BALL STEAM TRAP

(Formerly known as the J-M trap)

This trap of utmost simplicity in design and operation has but one moving part, a hollow, seamless copper ball which floats, unattached in the condensate within the trap body. More than a million of these traps in service attest to their economy of operation and effectiveness. Made in sizes from ¾" to 2" and in capacities from 600 to 800 lbs. water per hour. Also made in ½" "Junior Model."

THE CRYER THERMOSTATIC RADIATOR TRAP



Designed for use on two-pipe low pressure steam, vapor or vacuum heating systems. Operation is simple and effective and permits water, air and gases to pass from radiator into return line but prevents steam from doing so. Bellows of special alloy construction; stainless steel removable seat. Made in ½" and ¾" sizes for pressures up to 10 lbs.

CRYER TRAP & VALVE CO., INC.
MANUFACTURERS OF STEAM SPECIALTIES FOR MORE THAN 40 YEARS
366 MADISON AVE. NEW YORK, N. Y.

QUICKLY...WITHOUT WAITING FOR NEW BOILER DELIVERIES

• If you need more steam now—and can't wait for new boiler deliveries—it will pay you to investigate restokering your existing boilers with Stowe Stokers.

Due to their exclusive grate construction, Stowe Stokers permit the air necessary for efficient combustion to be supplied evenly and uniformly to all parts of the fuel bed, resulting, naturally, in exceedingly rapid burning,—and a much greater steam output from a given boiler than can possibly be secured with older less efficient stokering equipment.

Records on job after job in the utility, metal working, rubber and many other industries, show that boiler outputs have been increased from 33% to 100%, simply by restokering existing boilers with Stowe Stokers. These savings are not theoretical, but the actual proven results, secured by users, many of whose names you would instantly recognize.

We will be glad to have one of our engineers analyze your present facilities thoroughly and impartially, and tell you how much more steam you can reasonably expect to get by restokering with Stowe Stokers. Do not hesitate to write us fully about your situation,—or to send for our descriptive catalog. Write today!

THE JOHNSTON & JENNINGS CO.

DETROIT — 878 Addison Road, CLEVELAND, OHIO — CHICAGO

Engineering and Sales Representatives in
New York · Pittsburgh · Kansas City · St. Louis

STOWE STOKER

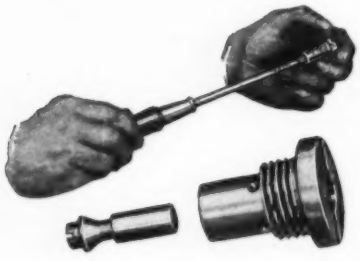
NOT AN UNDERFEED NOT A CHAIN GRATE

MORE SERVICE TIPS — *for Mason Regulators*

MASONEILAN

Number 5

How to Grind the Pilot Valve



After removing and disassembling the pilot valve, the valve may be ground by inserting the valve in the valve seat and turning with a screw driver fitted into the slot in the lower end, as shown.

Number 6

How to Grind the Main Valve

After lifting out the main valve and spring with the threaded screw eye, remove the spring and turn the screw eye again into the valve. Replace the valve in the body as shown and grind. Always use a "fine" grinding compound and be sure to clean valve and seat thoroughly after grinding.

Send for this Booklet

Complete instructions for the maintenance of your Mason No. 11 Regulators are yours for the asking. Get this booklet — keep your regulators in top condition.

MASON-NEILAN REGULATOR CO.
BOSTON, MASSACHUSETTS

July 15th

IS THE IMPORTANT DATE !

Effective July 15, 1943, Ladish Forged Steel Flanges will be sold through our own sales and distributing organization.

LADISH symbolizes over 41 years of service to industry and, as AMERICA'S LARGEST PRODUCER OF FORGED STEEL FLANGES, will continue to manufacture metallurgically controlled, uniform quality forgings unexcelled in the drop forge field.

ARMY E NAVY

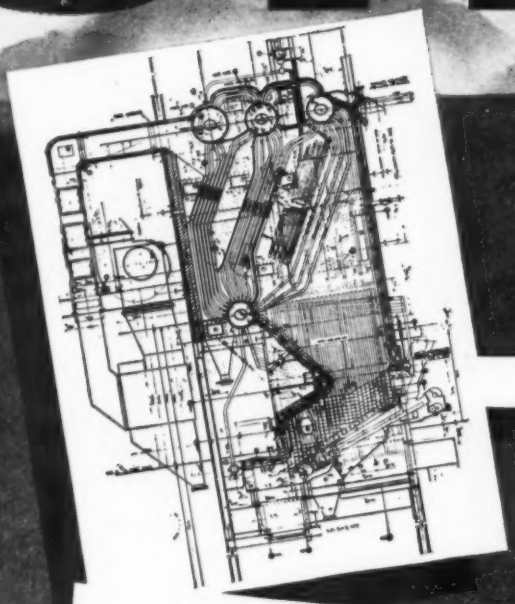
FITTINGS DIVISION

LADISH DROP FORGE CO.

CUDAHY [MILWAUKEE SUBURB] . . . WISCONSIN

TO MARK PROGRESS

STEAM *for*

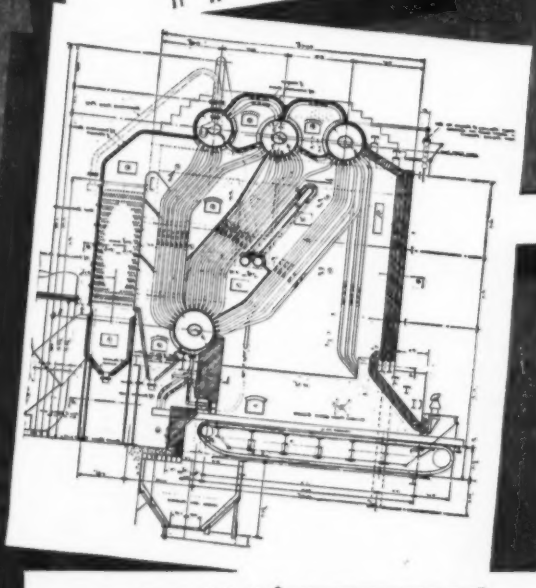


POWER

SOUTHERN COLORADO POWER COMPANY
Pueblo, Colo.

90,000 lbs. steam per hour Vogt LE type bent tube boiler with underfeed stoker. Water walls and economizer. Design pressure 525 lbs. Total steam temperature 750 degrees F.

•

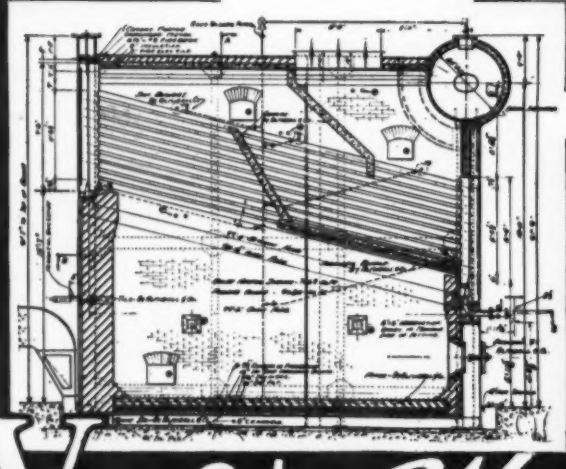


PROCESS

IN A LARGE MID-WESTERN STEEL MILL

Two 105,000 lbs. steam per hour Vogt LE type bent tube boilers with chain grate stokers and economizers. Design pressure 225 lbs. Total steam temperature 550 degrees F.

•



HEATING

CRIMINAL COURTS BUILDING AND JAIL
New York City

Four Vogt sectional header type boilers of 47,000 lbs. steam per hour capacity, oil fired. Design pressure 200 lbs.

HENRY VOGT MACHINE CO.
LOUISVILLE, KENTUCKY
Branch Offices: NEW YORK CLEVELAND
CHICAGO PHILADELPHIA TULSA

Vogt FOR BETTER BOILERS

Vogt *Water Tube* BOILERS
BENT TUBE AND SECTIONAL HEADER TYPES

THE M. W. KELLOGG COMPANY

Fabricators and Erectors

of

COMPLETE PIPING SYSTEMS

for

HIGH PRESSURE — HIGH TEMPERATURE
PUBLIC UTILITY and MARINE POWER PLANTS

* * *

PROCESS PIPING FOR INDUSTRY

* * *

Heat Transfer Equipment for Industrial and Marine Power Plants

KELLOGG

"Musterflex" Prefabricated Piping Systems • "Musterweld" pressure vessels for Power, Refinery and Chemical Industries. Heat Exchangers. Pyrolytic and Catalytic Cracking Units, Reforming, Dehydrogenation, Alkylation, Desulphurization. Thermal and Catalytic Polymerization Units • JUHK Processes for Lubricating Oil Plants. Plastic Refractories • Radial Brick Chimneys.

THE M. W. KELLOGG COMPANY • JERSEY CITY, NEW JERSEY • 225 BROADWAY, N. Y.

REPRESENTATIVES

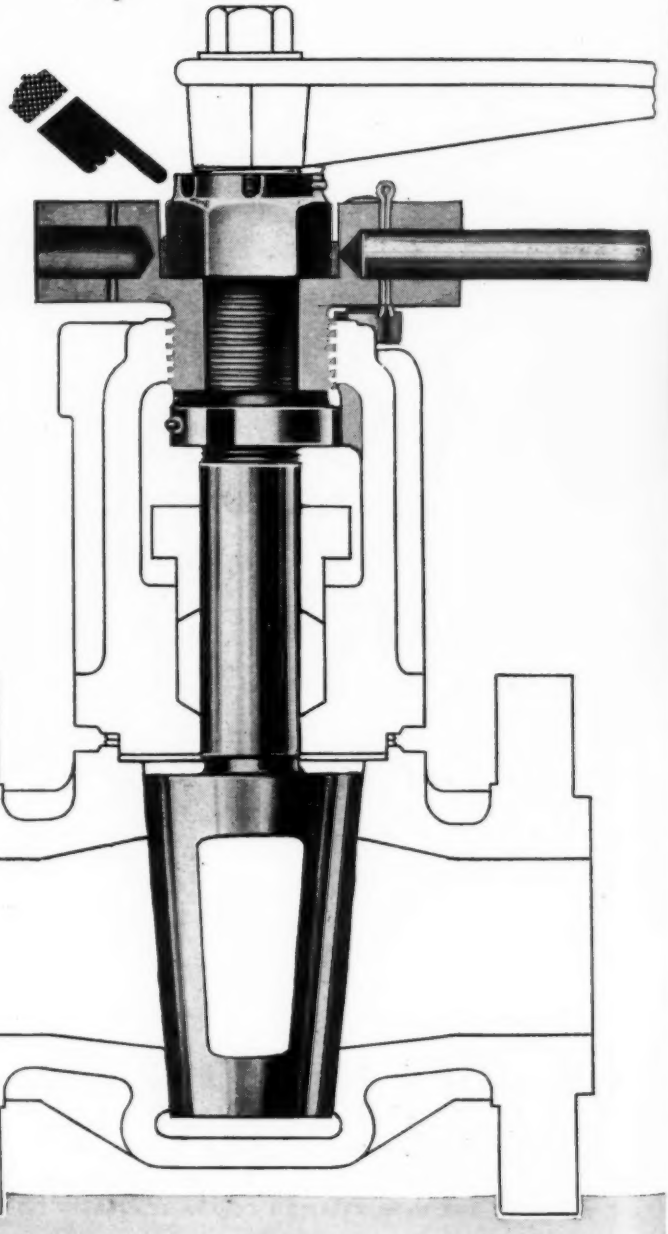
LOS ANGELES: 609 SOUTH GRAND — TULSA: PHILTOWER BLDG.

Here's why Homestead Lever-Seald Valves *are Stick-proof*

Valve failure, through sticking, just can't happen with Homestead Lever-Sealds in the line. Built right into these trouble-chasers is the mechanism which assures never-failing operation under every condition that causes ordinary valves to stick or "seize."

A powerful lever-and-screw device (shown by the shaded area in the cross-sectional drawing at right) easily relieves seating pressure between valve plug and body just enough to overcome friction and permit easy turning of the plug. A quarter-turn of the upper control lever then fully opens or closes the valve . . . instantly. At no time is the valve plug unseated. Full seating pressure is re-established by the lower lever for a positive leakless seal without lubrication.

Homestead Lever-Seald Valves are made in semi-steel, steel, or bronze, sizes 1½" to 10", for pressure ranges from 150 lbs. to 1500 lbs. Write for Valve Reference Book No. 38.

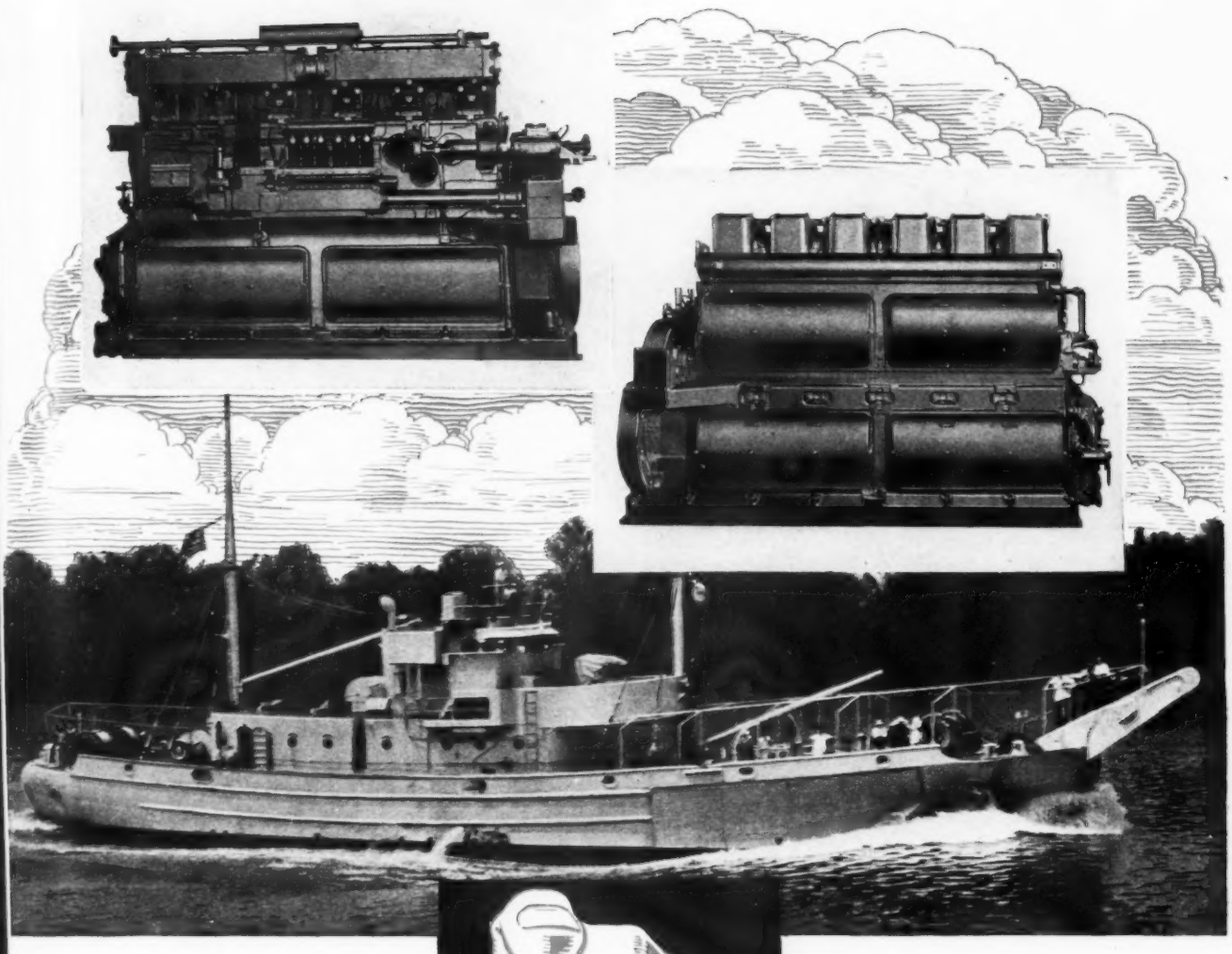


1. **Instant stick-proof operation.**
2. **Quarter-turn fully opens or closes.**
3. **Positive seal without lubrication.**
4. **Seating surfaces always protected.**
5. **Unobstructed straight-line fluid flow.**
6. **Outside leakage prevented.**

Maritime's two-flag, highest production award to our men and women making valves for the Victory Fleet.

Homestead LEVER-SEALD VALVES

HOMESTEAD VALVE MFG. CO. · · · P. O. BOX 20 · · · CORAOPOLIS, PA.



You *did it!*

It's you who are building the tanks, gun carriages, rifle springs, turret parts, bombs, Diesel engines, steam and Diesel locomotives coming out of our plants—and hundreds of other factories in this country.

It's you, the American people, with the money you put into war stamps, bonds, taxes, who are turning out the weapons coming off America's production lines—a volume of mobile power that will help to assure a decent world.

AMERICAN LOCOMOTIVE
AUBURN, NEW YORK

Here's the ANSWER to your DIRTY OIL problem

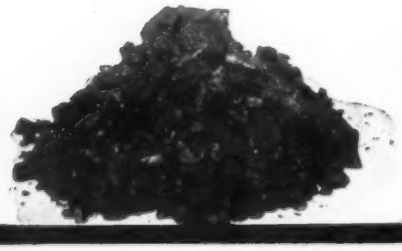
Dirty lubricating oil is a primary cause of excessive friction and rapid bearing wear—the enemies of smooth, dependable turbine or Diesel operation.

The De Laval Oil Purifier keeps lubricating oil clean—continuously and unfailingly. Thus, it enables oil to provide a maximum of protection to moving parts. At the same time, it enables the oil to be *safely* used over long periods.

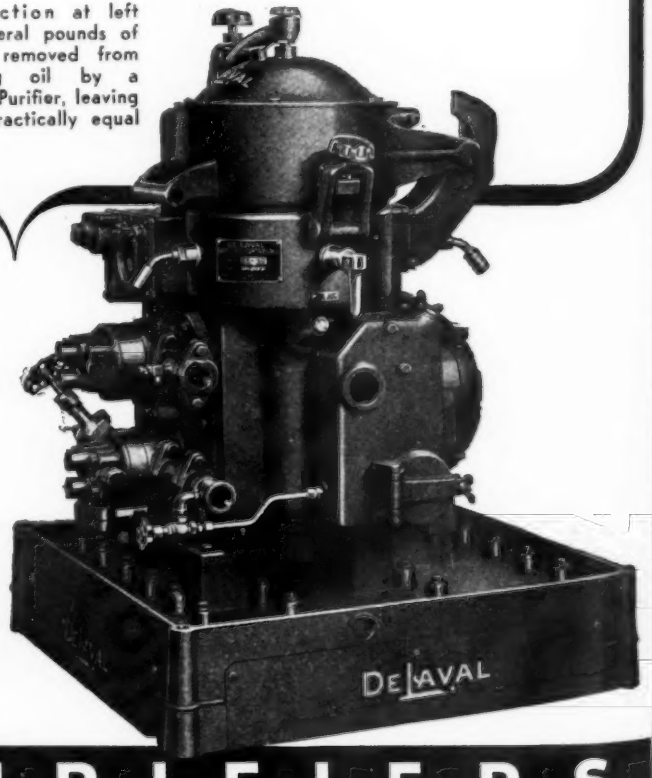
These facts, recognized for many years by builders and operators of prime movers, are now more important than ever.

—And now, too, the superiority of De Laval centrifugal purification is greater than ever before: still cleaner oil is delivered; capacities have been stepped up so that oil is purified more rapidly; machines are easier to handle—more nearly fool proof—and require less attention.

Bulletin will be gladly mailed upon request.



Reproduction at left shows several pounds of sediment removed from lubricating oil by a De Laval Purifier, leaving the oil practically equal to new.



THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York — 427 Randolph St., Chicago
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco
THE DE LAVAL COMPANY, Limited
MONTREAL PETERBOROUGH WINNIPEG VANCOUVER

DE LAVAL
OIL PURIFIERS

For BETTER Pressure Piping

The recently revised Code for Pressure Piping (sponsored by American Society of Mechanical Engineers and approved by American Standards Association) consists of more than 200 pages of authentic information that will be useful to anyone concerned with piping.

It contains detailed information on selection of proper materials, dimensional standards, maximum allowable stresses, rules for calculating flexibility of piping systems . . . as well as fabrication details such as welded joints, flange joints, hangers, testing, welding procedure and operator qualification, etc. If you make certain your piping conforms to this Code, you are assured it will not fall below the accepted standards of safety and good practice.

All qualified pipe fabricators comply with this Code. Its use is vital to the pre-fabrication of quality piping ... piping that is easier to install and more economical.

The Pipe Fabrication Institute will send this Code on request at the established price of $2.00 per copy.

CONFORM TO THE CODE

P.F.I.
THE PIPE FABRICATION INSTITUTE

THE PIPE FABRICATION INSTITUTE

Devoted to the Technical and Economic Problems in Piping

1108 CLARK BUILDING • PITTSBURGH, PA.

F-1

Looking ahead with Asbestos

"Leave it to that starter cartridge to do a job. A snap of the switch and the engine's *gotta* spin. Helps get a plane into the air—*sure*—when a split-second counts! Smart idea, that cartridge—and I understand one of the most important things in it is a small disk made of asbestos packing."

Right you are, Sergeant. That asbestos disk in the back of the cartridge directs the entire explosive action forward. What's more, it's K&M Asbestos Sheet Packing in 75% of all aircraft starter cartridges.

K&M is a name that a lot of airmen will remember when they go back to civilian jobs. They will know it stands for downright dependability. They will rely on it for better packing performance with air, steam, oil, water, acid or gas in the "V" years to come.

Emergency production for war has taught manufacturers many a lesson—and as with K&M, has pointed out the way to produce more, faster, with less. We have confidence that Industry will use this important lesson—aided by constant research—to help in building a better peacetime world

* * *

Nature made asbestos;
Keasbey & Mattison, America's asbestos pioneer,
has made it serve mankind . . . since 1873

KEASBEY & MATTISON
COMPANY, AMBLER, PENNSYLVANIA

Makers of

asbestos-cement shingles and wallboards; asbestos and magnesia insulations for pipes, boilers, furnaces; asbestos textiles; asbestos electrical materials; asbestos paper and millboard; asbestos marine insulations; asbestos acoustical material; asbestos packings; asbestos corrugated sheathing and flat lumbers; asbestos-cement pipe for water mains

Reproduction of one of a series of Dearborn advertisements prepared to explain the completeness of field service available from nearby offices.

DEARBORN ENGINEER IS
as near as your phone
APPLETON, WIS.
BALTIMORE, MD.
CHICAGO, ILL.
CINCINNATI, OHIO
CLEVELAND, OHIO
DAVENPORT, IOWA
DENVER, COLO.
DES MOINES, IOWA
DETROIT, MICH.
FORT WORTH, TEX.
GREENVILLE, S. C.
INDIANAPOLIS, IND.
LOS ANGELES, CALIF.
MILWAUKEE, WIS.
MINNEAPOLIS, MINN.
MONTREAL, QUEBEC, CAN.
NEW YORK, N. Y.
OKLAHOMA CITY, OKLA.
PHILADELPHIA, PA.
PITTSBURGH, PA.
PEORIA, ILL.
QUINCY, MASS.
ROCHESTER, N. Y.
ST. LOUIS, MO.
SAN FRANCISCO, CALIF.
SYRACUSE, N. Y.
TORONTO, ONTARIO, CAN.
TULSA, OKLA.
HONOLULU, T. H.
He knows how to solve your water problems... he can help you get highest steaming efficiency
When you're in trouble you need help right away! You can get it by phoning or writing the nearest Dearborn office. Dearborn Engineer is within quick calling distance of your plant. He knows the symptoms of boiler trouble resulting from improper treatment adjustment. He lives and works in the district where your plant is located. If your water is obtained from the local supply, he may even get off to a head start on solving your problem by referring to laboratory tests already on record.
On the job, he is the boiler water expert working with you and through whom you obtain the combined services of laboratory chemists, engineers, and other water conditioning specialists.
Keeping your boilers on the line is a "must". Dearborn Engineer is close by to help you. Write, wire, or telephone.
DEARBORN CHEMICAL COMPANY
Dept. D, 310 South Michigan Avenue, Chicago, Illinois
Dearborn
TRADE MARK REGISTERED
WATER TREATMENT AND ENGINEERING SERVICE

TALKING TO DEARBORN INDIANAPOLIS OFFICE:

"You'll be here within an hour... swell... we'll be waiting for you"

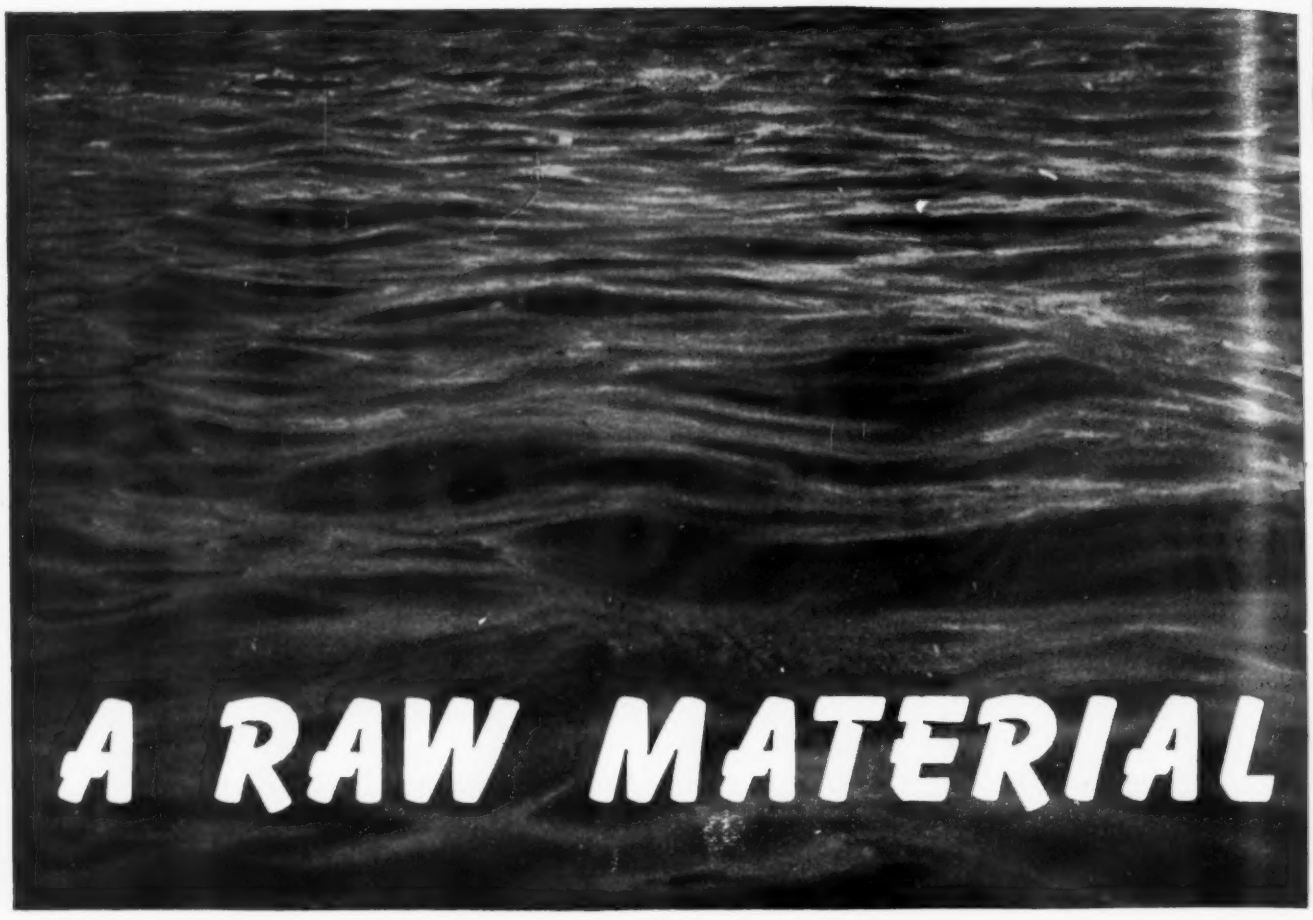
• That's typical of Dearborn field service. Right now you are located within easy calling distance of a Dearborn branch office. When in trouble, lift your phone and call for help. You'll be amazed how quickly the Dearborn engineers will be in your plant to serve you.

Of course, if you're one of the thousands of power plants using Dearborn service, the periodic calls of the Dearborn Engineer keep your boilers operating at peak efficiency with minimum need for emergency service. When you have trouble, due to bad water or improperly treated water, call for the Dearborn Engineer.

DEARBORN CHEMICAL COMPANY
Dept. D, 310 S. Michigan Ave.
Chicago, Illinois

Dearborn
TRADE MARK REGISTERED

BOILER WATER TREATMENT AND SERVICE



● Water is a raw material and to use it "as is," when it can be improved by treatment, is to work at low efficiency insofar as water influences production, the process and the product.

Infilco equipment for boiler and evaporator feedwater treatment, cooling water conditioning, condensate oil removal, steam purification, etc., is engineered and built to meet your specific requirements by an organization with 48 years experience. Infilco's staff is always ready to help you with your problems.

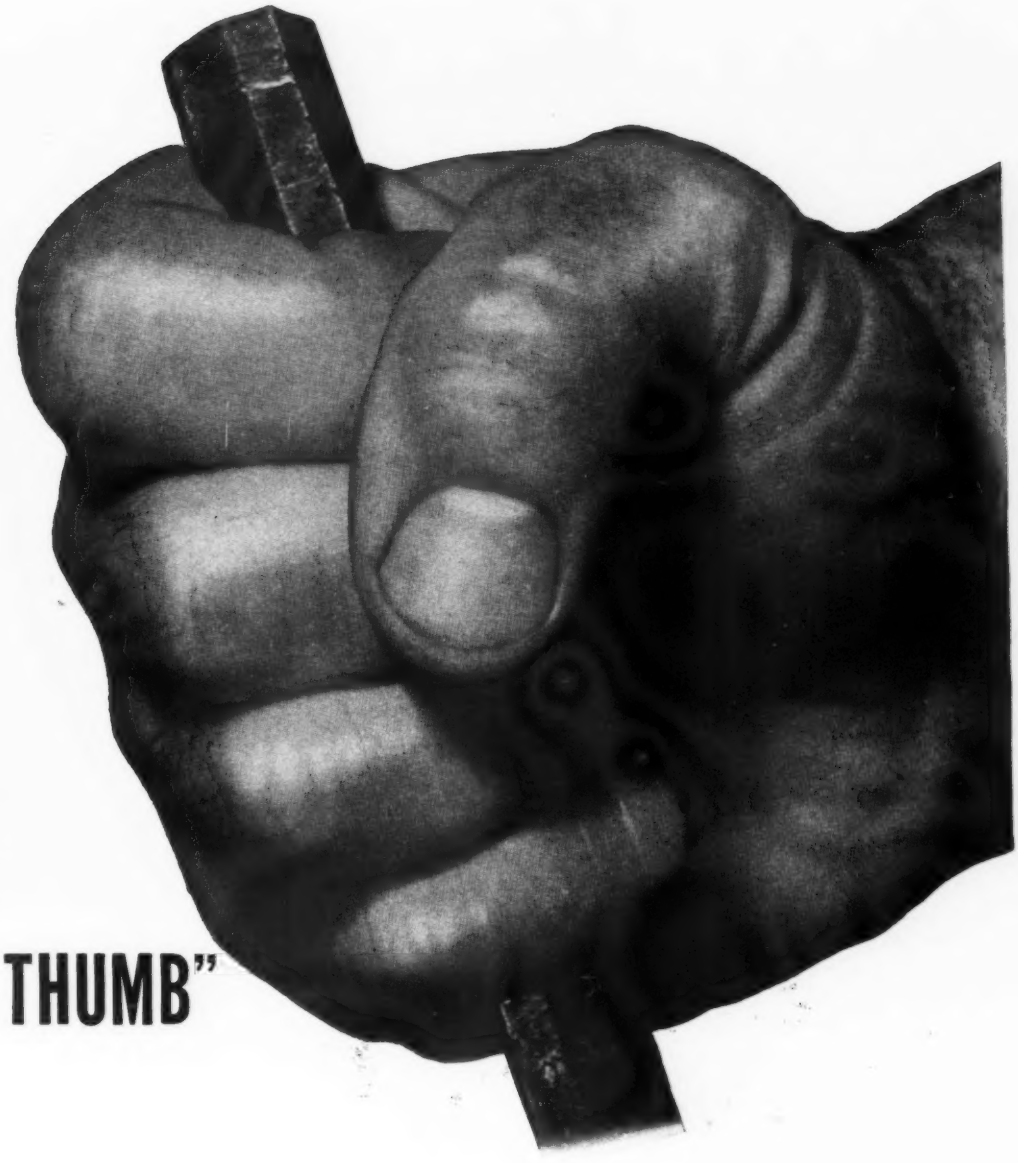
INFILCO
INCORPORATED

325 W. 25TH PLACE, CHICAGO, ILL.
Formerly **INTERNATIONAL FILTER CO.**

INFILCO

ACCELATOR SOFTENERS • CHEMICAL FEEDERS • PROPORTIONERS
WATER FILTERS • CLARIFIERS • COOLING WATER CONDITIONERS
CONDENSATE FILTERS • STEAM PURIFIERS • HOT-FLOW SOFTENERS
LIME-SODA SOFTENERS • ZEOLITE SOFTENERS • CATEXERS

INFILCO



BELTING AND HOSE WITH "THE THUMB"

It is the thumb that gives the human race its mastery and control of physical activity. It is the thumb that is absent in the lower animals. It is the thumb that symbolizes power and capability.

The reason we say "Belting and hose with 'the thumb'" is because the implication of that statement comes nearest to picturing the qualities that go into these and other Thermoid Products. The engineers and production technicians who produce Thermoid Industrial Rubber Products think in terms of end-use. They live the problems of the field. To them, for instance, the safety-factor requirements are not dry statistics, but matters of vital importance.

When "Thermoid" is on the products, everyone from the President down knows that the Purchasing Agent is buying the best that can be had.

P.S. In line with material conservation, Thermoid has prepared a series of bulletins on how to extend the life of rubber products now in use. You might find them helpful as reminders to be passed on to your operating people. Feel free to ask for copies.

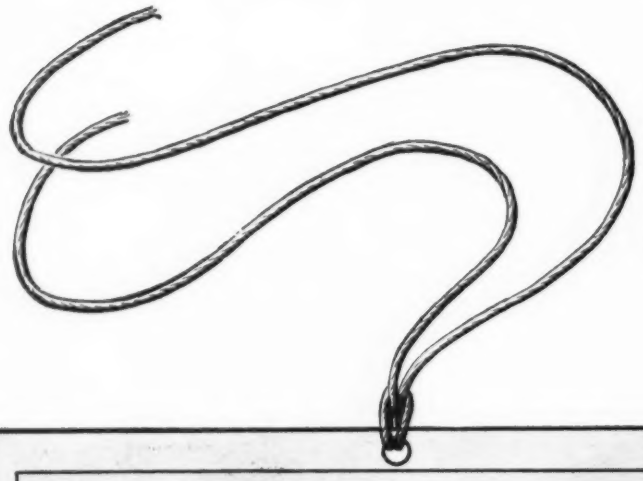
THE THERMOID LINE INCLUDES: Transmission Belting • F.H.P. and Multiple V-Belts and Drives • Conveyor Belting • Elevator Belting • Wrapped and Molded Hose • Sheet Packings • Industrial Brake Linings and Friction Products.

Thermoid Rubber

DIVISION OF THERMOID CO.
TRENTON, NEW JERSEY

IT'S GOOD BUSINESS TO DO BUSINESS WITH THERMOID

PLAY IT SAFER for the Duration!



TEMPERATURE RECORDERS

IMPORTANT POINTS
to get longer life, best service from
FOXBORO
REG. U. S. PAT. OFF.

TEMPERATURE RECORDERS

Now, more than ever, it is important to prolong the life of your Temperature Recorders and keep them operating continuously. With very simple care these instruments can be maintained to give continuous, accurate service almost indefinitely without repairs or replacements. Observance of a few simple rules and regular periodic checkups of the points listed below will assure maximum performance and trouble-free service.

Review the installation and maintenance instructions furnished with your Recorder. If the instruction book has been mislaid, send for another one, giving the instrument serial number.

If your checkup shows any likelihood of serious trouble, a Foxboro Engineer will be glad to help correct it. There is a Foxboro service office near you.

Keep in Mind The Following Points

- Temperature instruments operate by expansion and contraction of gas or liquid in a sealed thermal system, extending continuously from the bulb to the instrument. The slightest damage to this system may mean major repairs which may not be available under present conditions. Warn all workmen, especially electricians, who may have occasion to work around the instrument, that the capillary tubing should never be cut or broken. The tubing or bulb should never be used to carry or support the instrument.
- When the instrument is out of service for any length of time, (1) remove all ink from the pens, (2) shut off electric power supplied to the instrument.
- If the instrument service is changed, check the application very carefully, especially as regards corrosion. Check the data plate of the instrument to avoid rearranging and damaging the instrument.
- A spring chart drive should be lubricated every year or two, depending on the temperature to which it is subjected. Return the clock to The Foxboro Company or consult the instrument instructions.

Check These Points Now

- Can the instrument be relocated to advantage? Install it in a cool location and one as free as possible from vibration, corrosive fumes and vapors.
- Check the installation of the connecting tubing between bulb and instrument. Be sure there are no loose loops that might be caught and damaged by passers-by. Remove carefully any sharp kinks in the tubing.
- Examine the protection tubing for damage. Use acid-proof paint where substitute metal must meet corrosive service. If the protection tubing is damaged, repair it with tape to protect it from further damage.
- Examine the bulb socket — it is there to protect the bulb. If it is badly corroded, replace it with a new socket. This will save destruction of the bulb which would mean a major repair that may not be obtainable in wartime.
- Check bulb for signs of corrosion. Sometimes plating or coating with corrosion-resistant paints will prolong the bulb life. Consider also the use of a socket.

IF IN DOUBT, CALL A FOXBORO ENGINEER

THE FOXBORO COMPANY · FOXBORO, MASS., U. S. A.
Branches in principal cities of the U. S. and Canada

Get and use this simple Quick-Check Maintenance System

War years are no time to risk injuries to your temperature instruments. Repairs take time and materials badly needed for war production.

To help you block the possibilities of instrument damage through neglect or abuse, Foxboro now offers handy 8½" x 11" Quick-Check Cards of A-B-C maintenance instructions. In a few brief steps, they tell how to insure safe, positive maintenance of each major type of precision instrument. Equally useful for Foxboro or other standard instruments.

Write today for Quick-Check Cards that give simplified instructions for maintenance of your Recording Thermometers and Temperature Controllers. They're free! The Foxboro Company, 68 Neponset Avenue, Foxboro, Mass., U. S. A. Branches in principal cities of the United States and Canada.

"For outstanding production", The Foxboro Company has been awarded the Army-Navy "E" Pennant.

ARMY E NAVY

FOXBORO
REG. U. S. PAT. OFF.
Instruments

BE SURE . . . with CROCKER-WHEELER

Look anywhere in industry where motors and generators must resist damage, break down and wear . . . and there you will find Crocker-Wheeler. They have withstood the acid test of *time*.

Whatever your motor application problems may be, you may rely on the specialized knowledge of your Crocker-Wheeler field engineer. He is backed by a company which has *specialized* in the design and use of motors and generators for over 50 years.

Crocker-Wheeler Electric Manufacturing Co., Ampere, N. J.
Division of JOSHUA HENDY IRON WORKS

Other JOSHUA HENDY IRON WORKS factories at Sunnyvale, Pomona and Torrance, California and St. Louis, Mo.

Revolutionary...

NEW CLUTCH for all types of MACHINERY

12 advantages

1. Simple in design and operation
2. Flexible control by air
3. No adjustments or oiling—low maintenance
4. Dampens vibration—absorbs shocks
5. Corrects misalignment automatically
6. Smooth starting—no jerks
7. Runs cooler—uniform pressure
8. Controls torque by air pressure
9. Greater capacity—more compact
10. Remote control by air valve
11. Replaces couplings
12. Acts as clutch, slip-clutch or brake

It grips like a giant's fist—yet it can be slipped or "inched" at will. Starts smoother, runs cooler, under uniform pressure.

It is positive in operation, yet so flexible as to absorb terrific shocks and vibration, and corrects misalignment automatically.

It is long wearing—needs no bearings, levers or toggles—requires no adjustments—no lubrication. Its control is a single pneumatic valve.

It is the FAWICK AIRFLEX CLUTCH—new, but already *proved* in hundreds of installations for Navy, Merchant Marine and industrial Diesel drives, heavy duty presses, cranes and dredges, oil field drilling rigs and many other severe-service applications.

If you want positive insurance against the troubles common to conventional type clutches, you are invited to write us for information.

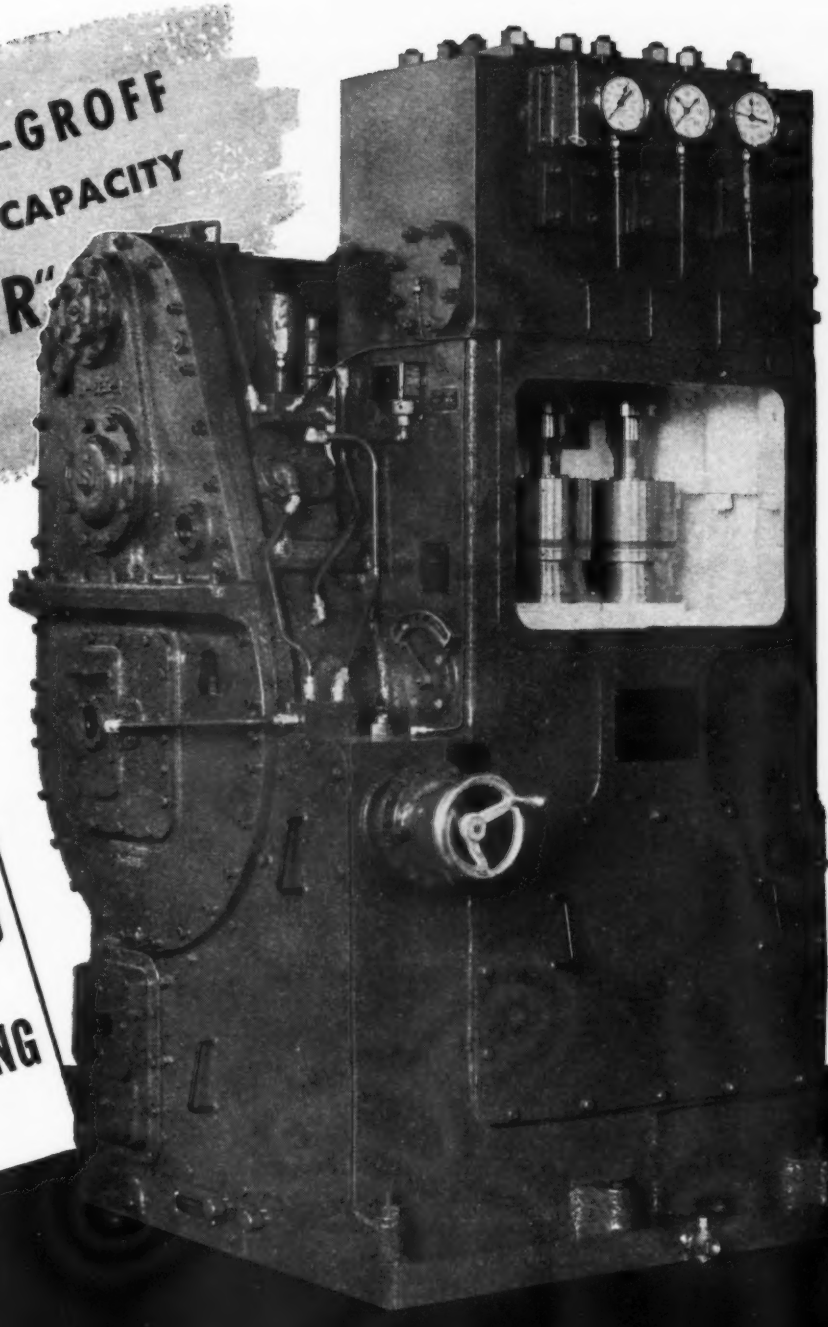
Fawick Airflex Company, Inc., 9919 Clinton Rd., Cleveland, Ohio

Fawick Airflex Clutches have proved their worth for heavy duty Diesel drives, steel mills, presses, power shovels, oil field equipment, compressors, hoists, motor generator drives, power takeoffs—any heavy duty service

FAWICK *Airflex* CLUTCH

POWER CONTROLLED BY AIR

THE ALDRICH-GROFF CONTROLLABLE CAPACITY "POWR-SAVR" PUMP . . .



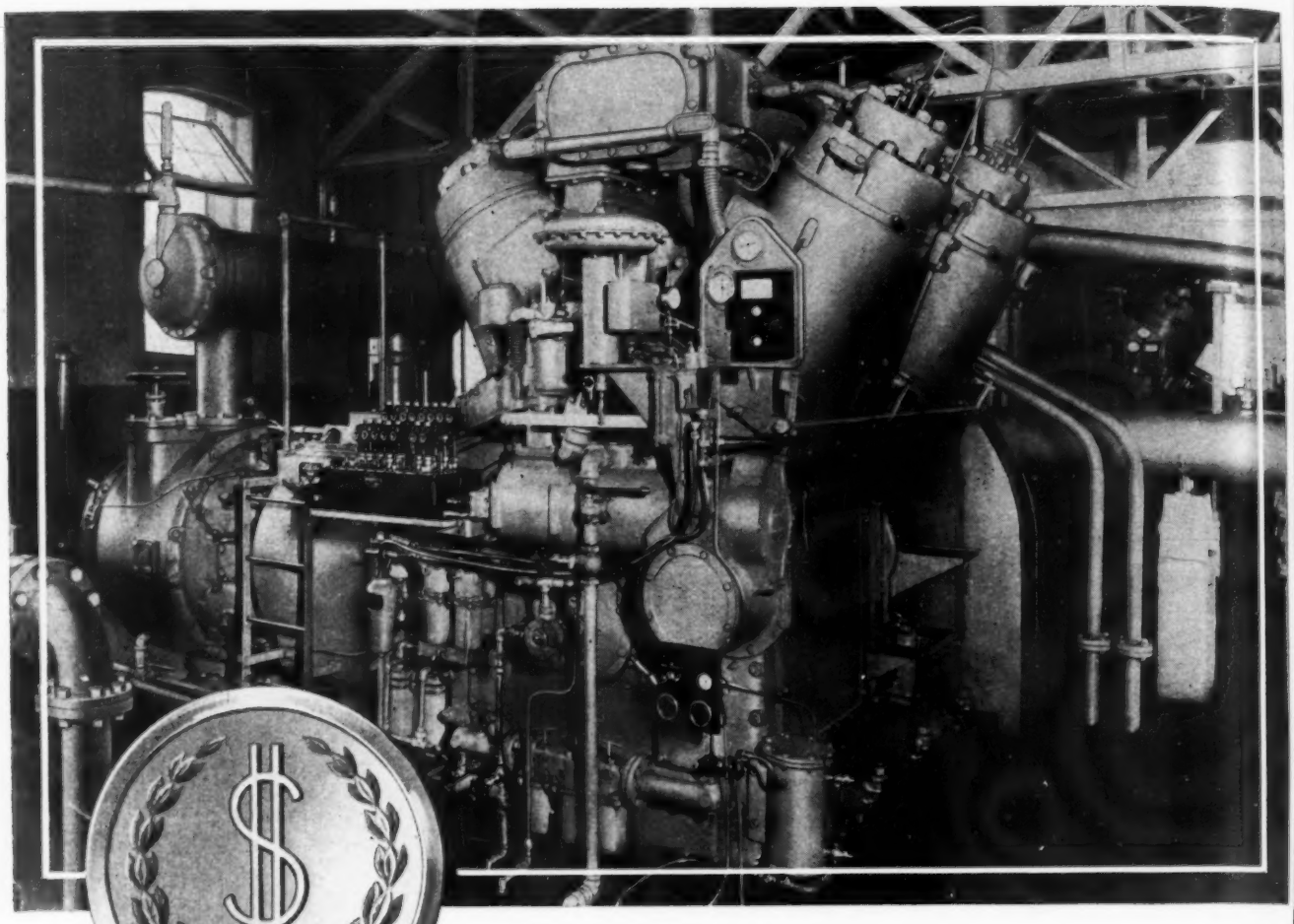
. . . for MAIN BOILER FEED and DESUPERHEATING SERVICE

Aldrich-Groff Pumps provide for automatic or remote manual control of delivery, from zero to full capacity, at constant pump speed. Rate of delivery is controlled by varying the length of the plunger stroke, and power consumption is almost directly proportional to pump delivery. These pumps combine the positive displacement and high efficiency of the plunger type pump with the flexibility and smoothness of a centrifugal.

The use of these pumps with unit feed systems eliminates the pressure and power losses associated with throttling-type feed-regulating valves. They provide advantages of feed system simplicity, efficiency and mechanical reliability for the small and medium boiler plant using medium and high steam pressures, and for de-superheater feed service in even the largest power stations. Over 100 units in operation on land and sea with outstanding service records.

Write today for the Aldrich Bulletin 65. It gives full details, sizes and ratings of Aldrich-Groff "Powr-Savr" Pumps.

THE ALDRICH PUMP CO. ALLENTOWN, PENNA.



SUN ANSWERS THE $64 QUESTION..

One of 9 Cooper-Bessemer Type G-MV-diesel-driven air compressors at the Chester, Pa., plant of Sun Shipbuilding and Dry Dock Company.

Compressed air lines are lifelines at Sun's Chester shipyard. To maintain them is a "must" — if ships are to meet and beat schedules, in answer to America's desperate shipping needs.

How to provide an unfailing supply of compressed air for vital operations was an easy question for Sun. They installed compressors which they knew could and would deliver . . . Cooper-Bessemer Type G-MV's . . . diesel-driven. Powerful 4-cylinder diesels, operating compressor cylinders in pairs, run night and day, month in, month out . . . efficiently, dependably, economically. Air pressure is always instantaneous, adequate, uniform.

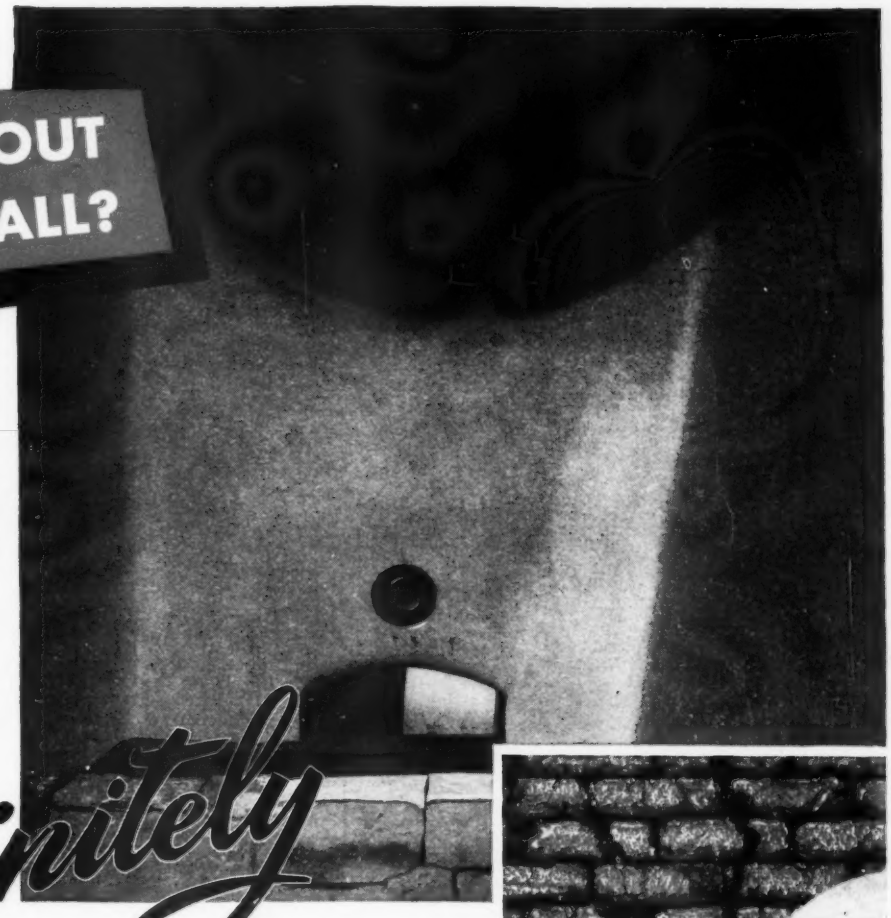
G-MV air compressors are available today, either gas engines or Diesel engine driven. If yours is a vital war industry and you need dependable compressed air, call on Cooper-Bessemer.

The Cooper-Bessemer Corporation

MOUNT VERNON, OHIO GROVE CITY, PENNA.

New York Washington Gloucester, Mass. St. Louis Houston Los Angeles Seattle New Orleans

WHY TEAR OUT THE OLD WALL?



FEDERAL PYROKOTE WILL PROLONG THE LIFE OF A FURNACE *Indefinitely*

FOR a fraction of the cost of a reline you can rebuild an old furnace wall that will actually outwear a new refractory lining!

Federal Pyrokote is an easily applied plastic refractory coating that bonds tightly to old furnace walls. It can be applied by air spray gun or trowel, from 1/8" up to any desired thickness. Federal Pyrokote forms an extremely hard, dense surface, sealing all joints and cracks, creating a monolithic wall highly resistant to slag attacks, flame abrasion, and preventing air infiltration. Federal Pyrokote will withstand heat up to 3000° F.

Federal Pyrokote was developed by Federal Refractories engineers, working in conjunction with the research and technical staff of The U. S. Stoneware Company, leaders in the field of industrial ceramics for more than seventy-five years.

Federal Pyrokote has been tested under every conceivable type of service. Not until we knew exactly how Pyrokote would stand up against the tough conditions of wartime operations did we announce it to the field.

Every test indicates that an old furnace wall coated with Federal Pyrokote will actually outlast a new wall!

Pyrokote seals open joints and cracks. Highly resistant to slagging and flame abrasion. Prevents air infiltration.

★

Write today for literature and samples. Address Federal Refractories Corp., Akron, Ohio. In Canada: Chamberlain Engineering, Ltd., Montreal.

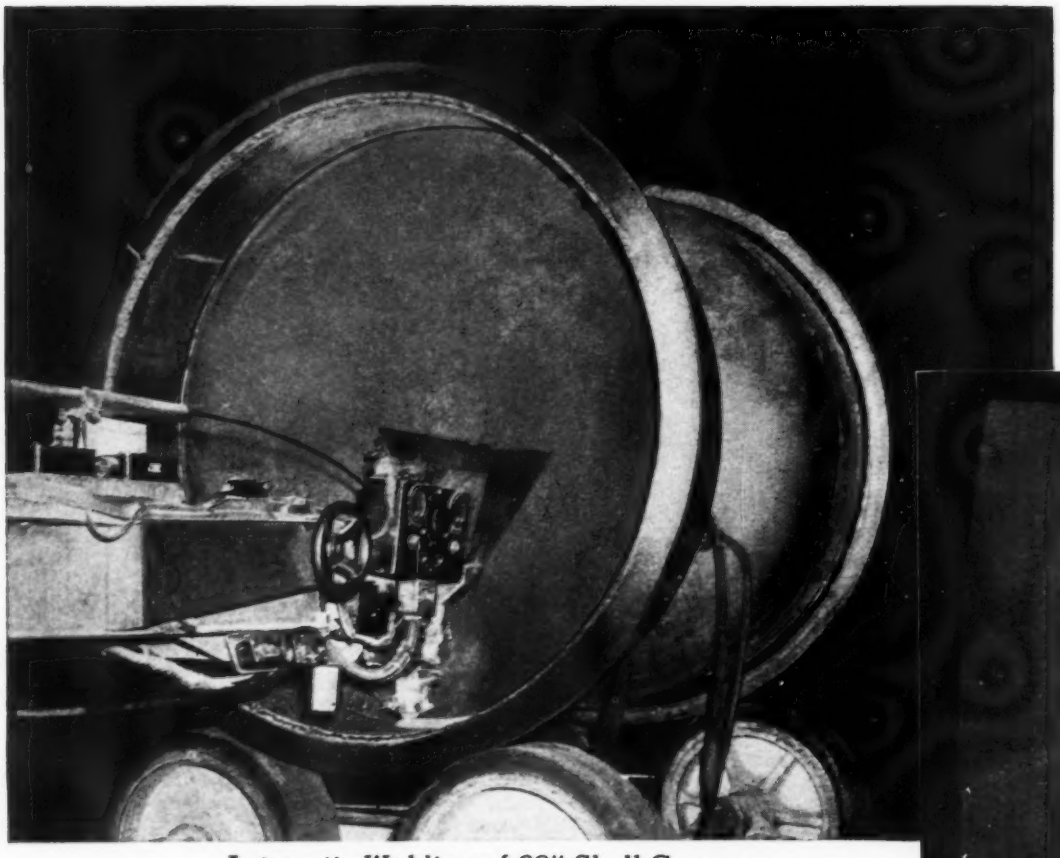
Federal

REFRACTORIES CORPORATION

AKRON, OHIO

IN CANADA: CHAMBERLAIN ENGINEERING, LTD. MONTREAL

A UNIT OF THE U. S. STONEWARE COMPANY



Automatic Welding of 60" Shell Covers

Typical Girth Weld
(Unretouched)

ALCO

ENGINEERS and MANUFACTURERS

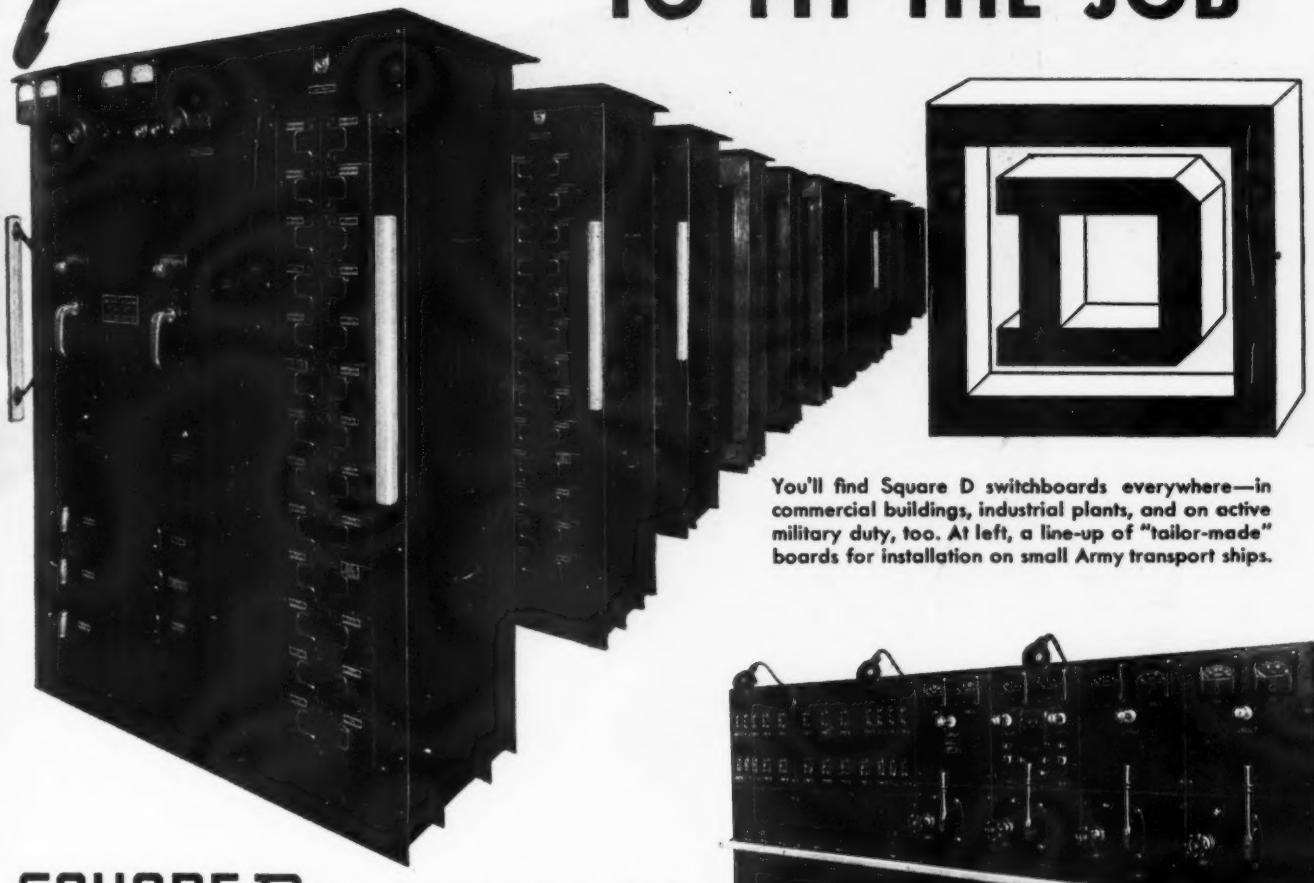
ALCO development of automatic welding for heat exchanger shells, heads, and covers insures welding of highest quality, unsurpassed in strength, durability and appearance.

AMERICAN LOCOMOTIVE COMPANY

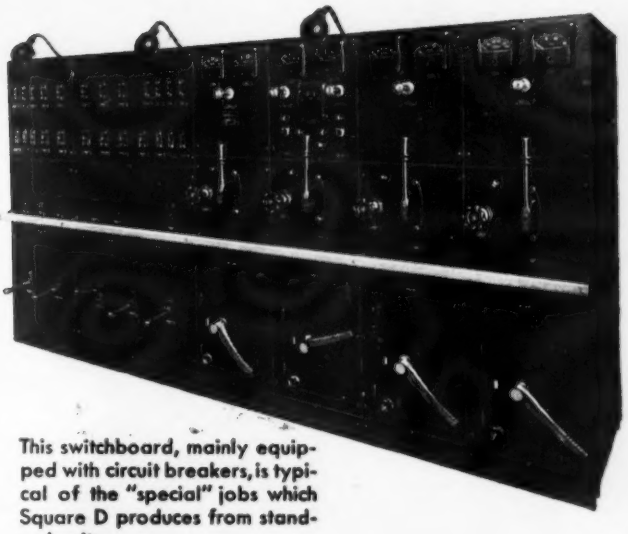
ALCO PRODUCTS DIVISION

30 CHURCH ST., NEW YORK, N. Y. **DUNKIRK, N. Y.**

Tailored TO FIT THE JOB



You'll find Square D switchboards everywhere—in commercial buildings, industrial plants, and on active military duty, too. At left, a line-up of "tailor-made" boards for installation on small Army transport ships.



This switchboard, mainly equipped with circuit breakers, is typical of the "special" jobs which Square D produces from standard units.

SQUARE D SWITCHBOARDS

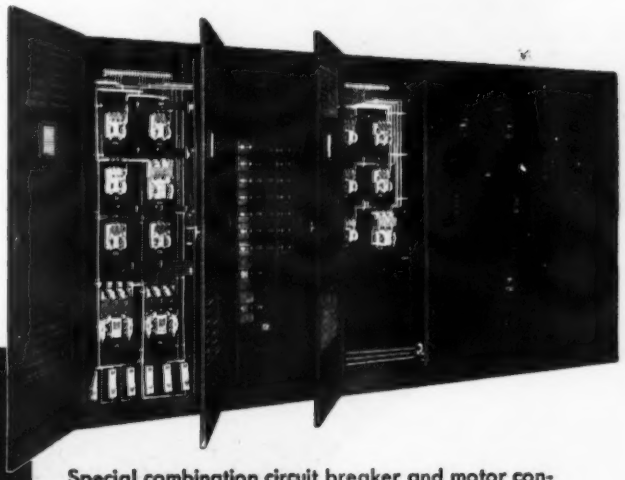
FOR COMMERCIAL AND INDUSTRIAL BUILDINGS

There is more than good workmanship involved in building switchboards. It takes a sound analysis of requirements by an engineer who knows his stuff, technically. (That's the Square D Field Engineer.) And it takes seasoned design engineers who chart the course for the men who build them. (Years of experience have taught Square D designers the angles which really count.)

CALL IN A SQUARE D FIELD ENGINEER

You're welcome to the counsel of a Square D Field Engineer in tackling any problem which involves electrical control or distribution. He is in constant contact with plants of every kind and size. He studies methods and applications with the idea of simplifying new jobs or doing old ones better.

There are Square D Field Engineering offices in 52 principal United States and Canadian cities.



Special combination circuit breaker and motor control switchboard, with ten panels. Panels are arranged back-to-back to conserve space.

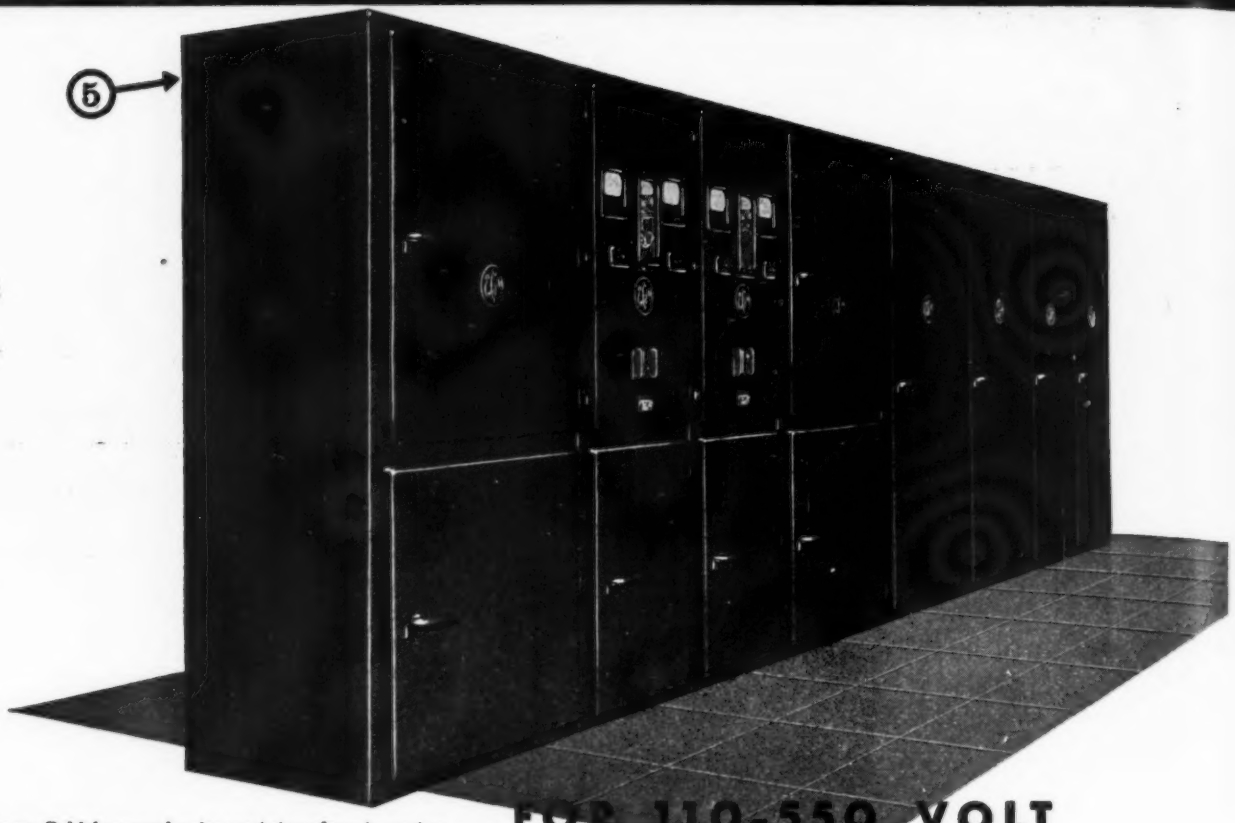
SQUARE D COMPANY

DETROIT - MILWAUKEE - LOS ANGELES

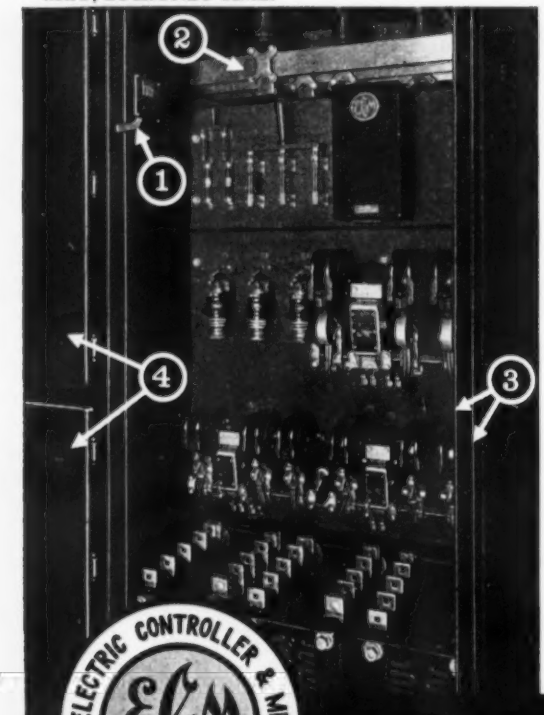
KOLLSMAN INSTRUMENT DIVISION, ELMHURST, NEW YORK

IN CANADA: SQUARE D COMPANY CANADA LIMITED, TORONTO, ONTARIO

EC&M *Steel-Clad* MOTOR CONTROL



● *Above:* Cubicle control units consisting of two incoming line panels and starter units for six low voltage motors.
● *Below:* Close-up view of a primary-resistor type starter for 150 h.p., 440 volt squirrel-cage motor, with acceleration by EC&M NEO-TIME.



FOR 110-550 VOLT *Squirrel Cage* MOTORS

This control comes completely wired, hence is quickly installed. It is actually custom-built, yet so designed and constructed that additional units can be easily added when needed.

It offers many outstanding features, among which are:

1. Safety interlocks on all starter units.
2. Self-contained bus between units when arranged for group installation.
3. Semi-dust-tite enclosure (NEMA Type 1A).
4. Utmost accessibility through front doors and rear plates.
5. Removable plate on end unit for bus extension when adding units for a group installation.

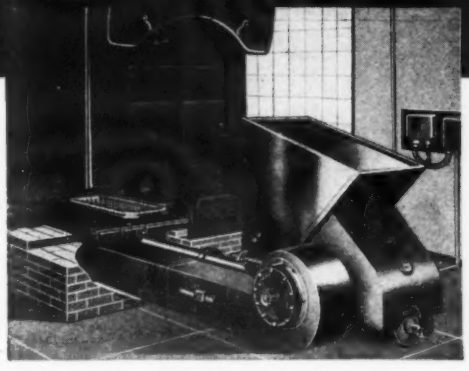
Today, EC&M Steel-clad Motor Control Units are in use practically everywhere . . . in steel mills, coal mines, refineries, municipal pumping stations, industrial plants, etc. Being totally enclosed and shock-proof, they offer important protection to workmen. Full details are contained in 16-page illustrated Booklet No. 67. Copy upon request.

THE ELECTRIC CONTROLLER & MFG. CO. CLEVELAND, OHIO

THE ELECTRIC CONTROLLER & MFG. CO.

CLEVELAND ★ OHIO

YOU CAN'T OPERATE WITHOUT HEAT!

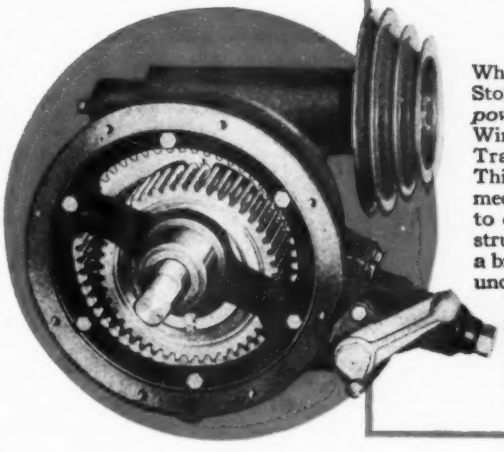


BEAT THE FUEL OIL SHORTAGE WITH A *WINKLER STOKER!*

In recognition of the fuel crisis, the War Production Board has permitted us to resume the manufacture of commercial and industrial stokers. Large users of fuel oil can now protect against shut-down and production loss by converting at once to coal—*the plentiful fuel!*

EASY CONVERSION TO WINKLER AUTOMATIC STOKER-FIRING

Converting your plant from oil-firing to stoker-firing is handled without fuss or bother by expert Winkler installation men. Thereafter your Winkler automatically operates with minimum attention . . . smokelessly . . . dependably . . . holding steam pressure and temperature exactly where you want it. In thousands of installations, maintenance on Winkler Stokers has proved to be practically nil.



EXTRA POWER

When you install a Winkler Stoker you get the *extra power* only the famous Winkler Inter-Planetary Transmission can give. This revolutionary driving mechanism has the ability to crush 90% of the obstructions in the coal which ordinarily cause a breakdown. If the obstruction should prove uncrushable, the Locked Screw Safety Release disengages and resets the Transmission until the cause is removed. No shear pins to replace—no overload switches to reset—the Winkler has the only *fully automatic stoker transmission, guaranteed for three years!*

PHONE OR WRITE NOW!

Your local Winkler dealer will give you full information . . . or write direct to the factory.

COMPLETE ENGINEERING SERVICE . . . PRIORITY ASSISTANCE

A thorough analysis of your heating problem is made by competent stoker engineers. This survey information is sent to the Winkler Factory, where a set of installation blueprints is prepared by expert technicians. A Winkler Stoker installation is thus carefully tailored to your specific requirements. Full assistance is given in making out the necessary forms for obtaining WPB approval. Call your local Winkler dealer or write the factory for full information.

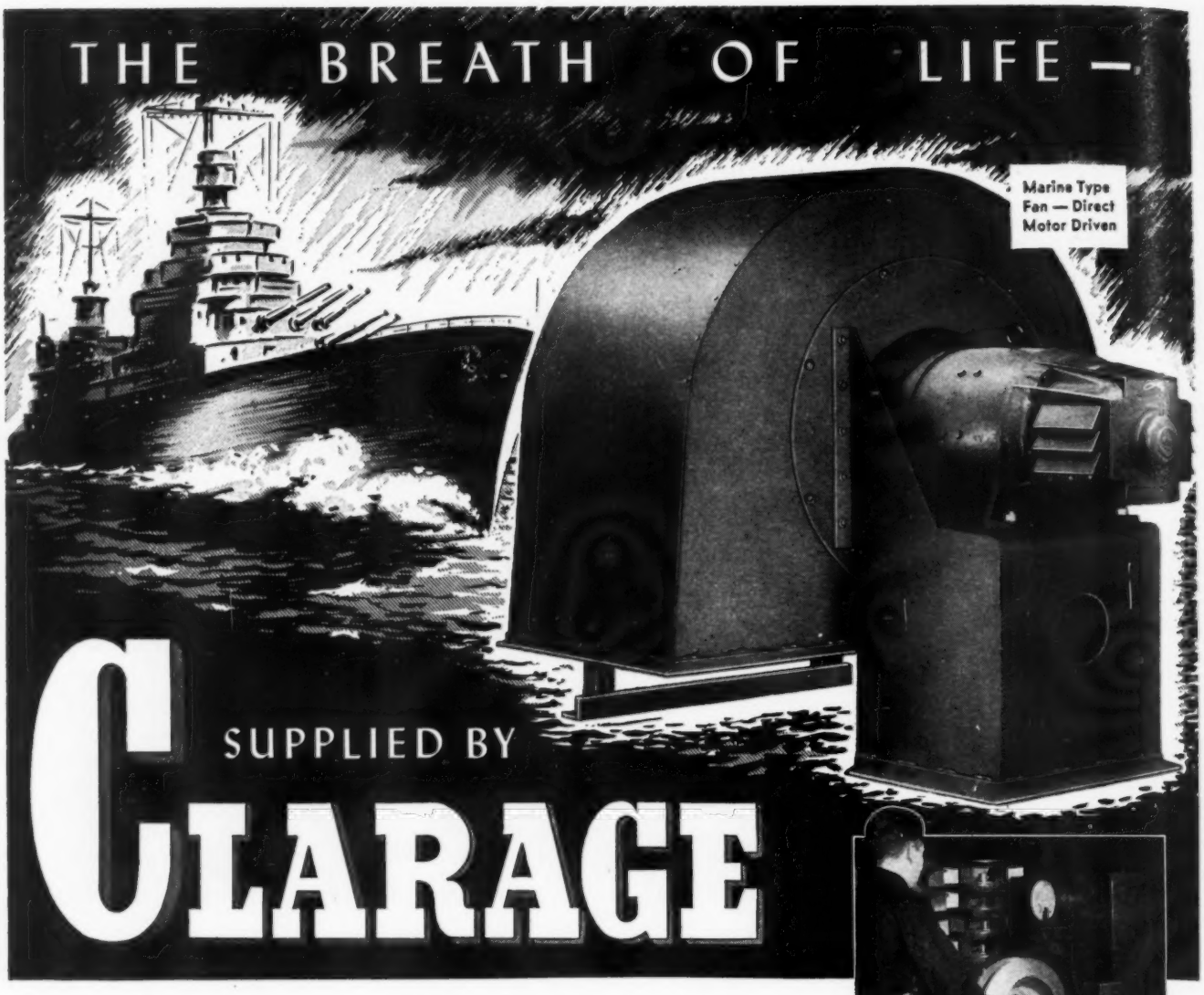
We are proud to announce that the Army-Navy Production Award has been conferred on the Winkler Factory Organization.

WINKLER

fully automatic STOKERS

U. S. MACHINE CORPORATION • LEBANON, INDIANA

THE BREATH OF LIFE—



SUPPLIED BY

CLARAGE

One of our Important War-time Assignments is the Building of Ventilating Fans for Thousands of Fighting and Merchant Ships

Down in the hold of a modern ship — freighter or battle wagon — *men can't live without mechanical ventilation.*

★ The Clarage marine type fans which supply the vital fresh air are engineered and built for this one job. They are all steel — no cast iron. Cast iron is out because it shatters and acts like shrapnel when hit by gunfire or torpedo — the flying pieces endangering lives. Steel also means less weight, and that's important on shipboard.

★ Compactness is another desired feature. Clarage gets this by streamlining the fan housing and by mounting the fan wheel directly on the motor shaft — space saved from 20 to 35%.

★ But building marine type fans is only one of many air-handling problems, created by war, which Clarage is today successfully handling. *Perhaps our biggest job is helping industry speed vital production.*

★ If you need any type of air-handling equipment for use in connection with war work, *call in the nearest Clarage application engineer.* You will find our engineering facilities adequate to give you the kind of service you should and must have.

TESTING FANS FOR NAVY SERVICE

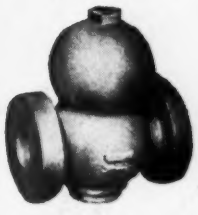
Clarage fan wheels are statically and dynamically balanced to eliminate vibration as far as humanly possible. Precision methods are employed, using the most sensitive testing machines obtainable. By conquering wheel vibration, the shaft and bearings of Clarage fans are protected against excessive wear — and noisy operation. Then, after assembly, complete fan units are power tested, making certain all parts are functioning properly.

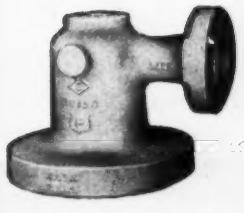
COMPLETE AIR CONDITIONING
•
COOLING
•
VENTILATION
•
FACTORY HEATING
•
MECHANICAL DRAFT
•
FANS and BLOWERS for INDUSTRIAL NEEDS

Clarage Fan Company Kalamazoo, Mich.

APPLICATION ENGINEERING OFFICES IN ALL PRINCIPAL CITIES

SIVYER STEEL CASTINGS





PLANNING MAKES WORTH LOOKING FOR

Getting off to a good start is important when you're making steel castings good enough to wear the Sivyer trademark. Because quality is something that must be part of every phase of production, Sivyer plans that quality in each job before a pound of scrap is charged into a furnace. Here's a candid camera shot of a Sivyer Job Planning group. It includes the foundry superintendent, a metallurgist from our research laboratory, a pattern expert, the melter, and the foremen of the pouring, molding, heat-treating and finishing departments. Each studies the job, recommends proper procedure, and arranges the necessary supervision to make sure the job is handled right at every step. And it's being right at every step that is responsible for casting quality.

SIVYER STEEL CASTING COMPANY
MILWAUKEE CHICAGO

ARMY E NAVY

Now it can be done!

NEW ORDERS FOR

ROSS SURFACE CONDENSERS

CAN BE COMPLETED IN

4th Quarter of this Year

Ross 10,000 Sq. Ft. All Welded Steel Surface Condenser. Twin Bank. Balanced Flow.

Improved and expanded production facilities at Ross Heater & Mfg. Co., Inc. clear the way for acceptance of new orders **now** for Surface Condenser fabrication with a "4th Quarter—1943" deadline.

If, therefore, your condenser requirements for this year fit into the "Small" or "Medium" size classification, consult any of the Ross offices in principal cities throughout the country, or contact the plant direct.

Ross engineers will study your operating conditions and submit practical recommendations based on a great many years' experience building condensers in this range of sizes.

Manufacturers of All Kinds of Heat Exchangers for over a Quarter Century

ROSS HEATER & MFG. COMPANY, INC.

Division of American Radiator and Standard Sanitary Corporation

MAIN OFFICE AND PLANT 1409 WEST AVENUE BUFFALO, N. Y.

WRITE FOR A COPY OF BULLETIN CO-5

WING

ADAPTABLE TO ALL TYPES OF BOILERS

Hand-Fired, Stoker-Fired, Oil-Fired, Gas-Fired, Bagasse-Fired, Pulverized Coal-Fired, etc.

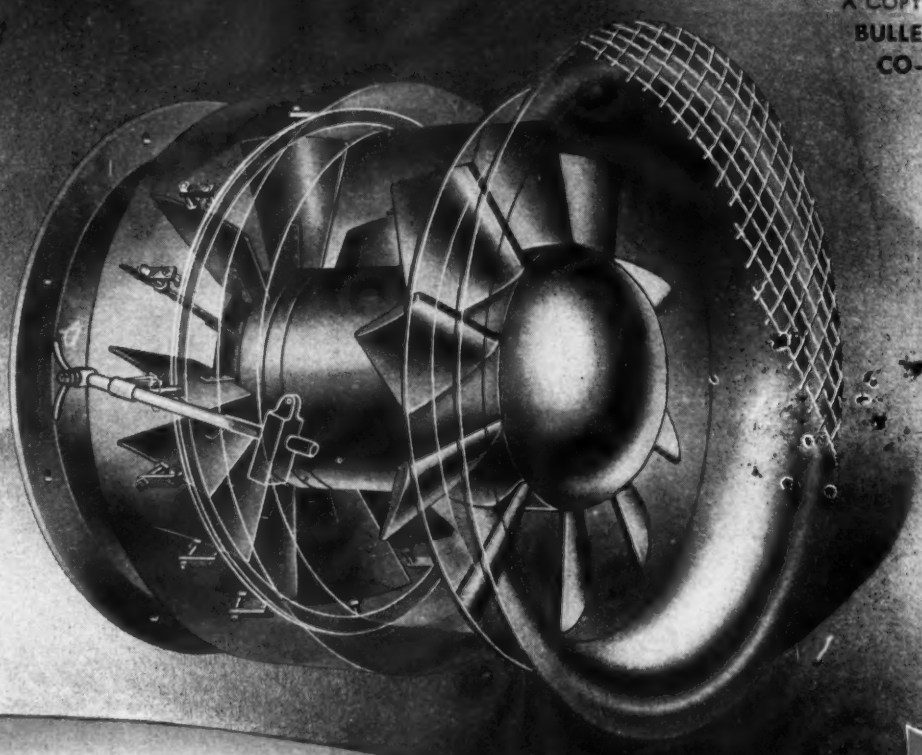
WING SINGLE-STAGE BLOWER

TYPE EMD

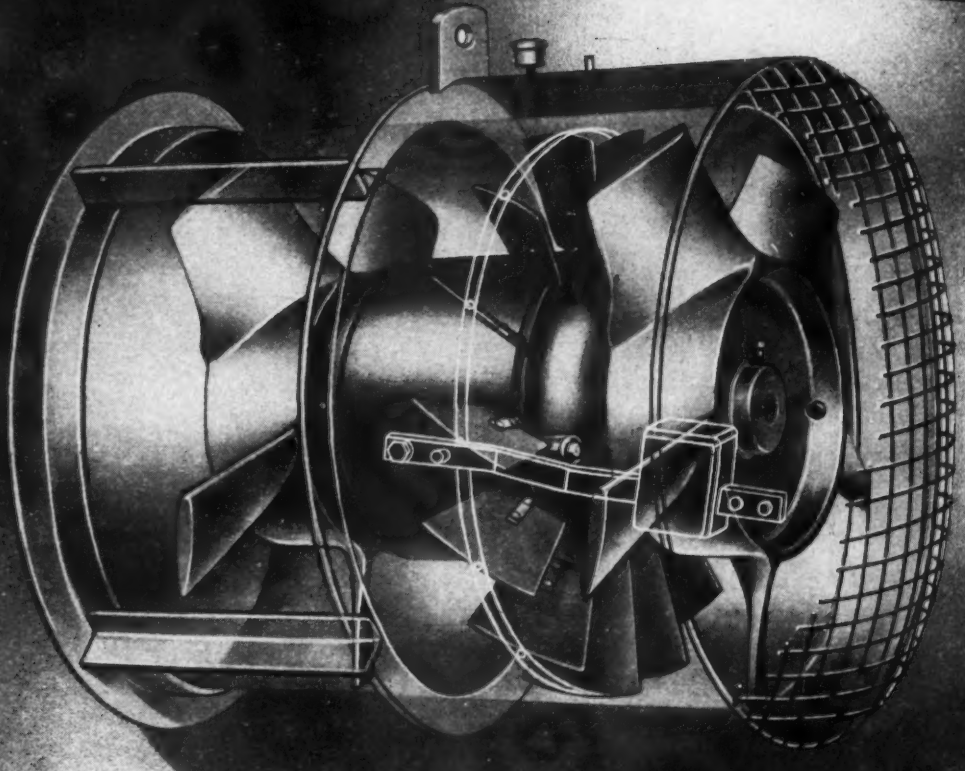
CAPACITY REGULATION BY BUILT-IN VOLUME CONTROL

(Wing Voltrol-Vanes)

Internal radial dampers are actuated by an external balanced lever. This can be adjusted manually or connected to any standard combustion control regulation. It is precise in action and a reduction of volume is accompanied by a reduction of horsepower over a wide range.



WING AXIAL FLOW BLOWERS with VOLTROL-VANES



HIGH EFFICIENCY
Total Head Efficiencies Run 90% and Higher

NON-OVERLOADING HORSE-POWER CHARACTERISTICS

WING TWO-STAGE BLOWER

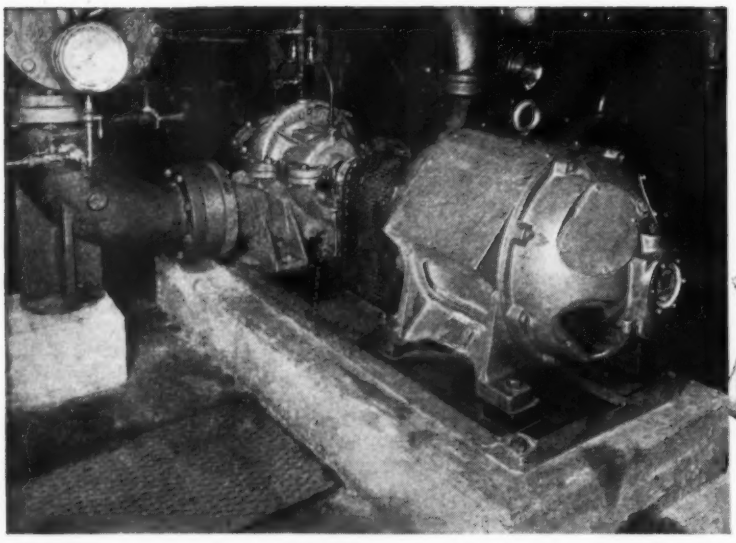
TYPE COM

COMPACTNESS
Economy of Space and Weight

EASE OF CONTROL

QUIET OPERATION

14th St. at 7th Ave., New [illegible], N. Y. L. J. WING MFG. CO. Factories: Newark, N. J.



Pumps, too, can be overworked!

Manpower shortage throws additional strain on supervisory personnel. It is a real problem. Under pressure of wartime schedules, periodical check-up of physical condition is often neglected.

Pumps, too, can be overworked. And, like human hearts, mechanical pumps can be neglected.

CAUTION! Don't push pumps continuously beyond their rated capacity. They can take it for a time but there *IS* a time limit!

The more dependable a pump, the easier it is to neglect it.

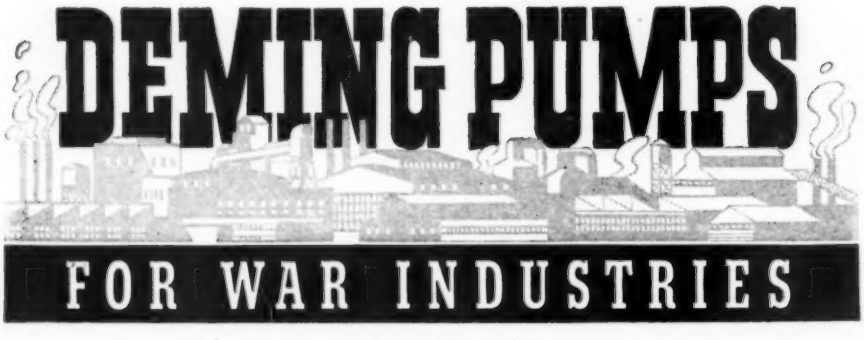
The big danger of neglecting to check up on a human pump—the HEART—is basically the same danger as neglecting to check up on a mechanical pump.

There are Doctors for human pumps. There are Deming Distributors for mechanical pumps. The time to see BOTH is BEFORE emergencies develop.

Your Deming Distributor will be glad to cooperate in a physical check-up of your pumping equipment. If new pumps are required, every permissible effort will be made to see that your needs are supplied.

THE DEMING CO. • SALEM, OHIO

CALL IN YOUR DEMING DISTRIBUTOR



No. 2 in a series of tributes to America's War Industries

MAKING MINCE-MEAT OUT OF PANZERS!

They jab and stab, they slug and smash. On and on they roll . . . devouring Nazi panzers as they go . . . leaving in their wakes the shattered, burned-out carcasses of these mechanical beasts. Lights, mediums, heavies . . . Lees, Shermans, Grants . . . they outspeed, out-shoot, out-maneuver, out-last anything the frantic "supermen" can create. These are the tanks that American industry builds.

In quality, the world has never seen their equal. In quantity, this vital tool of war is coming off our production lines like pennies out of a mint. For both, the civilized world can thank American industry . . . its genius for producing the most of the best.

And what this genius is doing for tanks, it is also doing for planes, guns, ships, ammunition . . . every phase of our war production. American industrial might . . . all its muscle, all its skill, all its determination . . . is all-out for the blood of the Axis!

IN PLANTS OF ALL TYPES

TODD BURNERS

ARE WORKING FOR VICTORY

Wherever trouble-free, dependable combustion of liquid and gaseous fuels is a necessity . . . in war plants, in countless merchant and fighting ships . . . Todd Burners are delivering unsurpassed performance in the production of heat and power.

TODD SHIPYARDS CORPORATION

TODD COMBUSTION DIVISION

601 West 26th Street, New York City

NEW YORK · MOBILE · NEW ORLEANS · GALVESTON
SEATTLE · BUENOS AIRES · LONDON

TODD BURNERS ★ ★ ON THE FIRING LINE OF AMERICA'S WAR PRODUCTION FRONT

Dead Reckoning's Out...

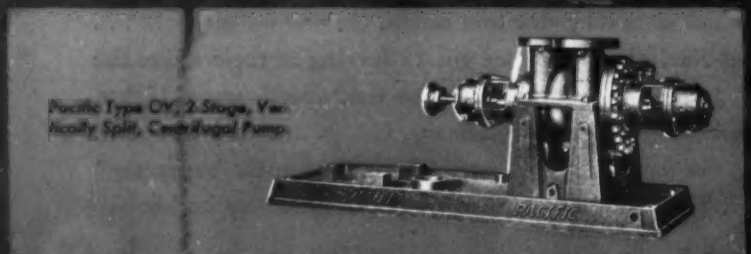
IN BUILDING PACIFIC PUMP

Today you need more than a log and compass to get there! need a knowledge of trigonometry, sextants, Bowditchs, wind, and shoals charts.

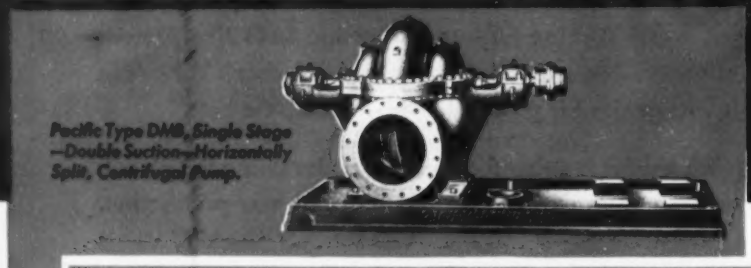
In building Pacific Pumps, our designers, research men and engin don't go by guess or by gosh. They *know* where they're going.

Pacific Pumps have gotten there through years of careful stud the laboratory and in the field. They have "arrived" becaus the application of as near exact science as it is humanly possibl apply to their construction and development.

When you see a Pacific Pump in operation in your plant or in thousands of plants throughout the world, think of the long hou scientific "reckoning" that went into their manufacture. When see Pacific Pumps delivering uninterrupted fluid service under and all pumping conditions, remember that back of them is never-ending study of trained engineers whose lives are dedica to giving you the most perfect pumping equipment possible.



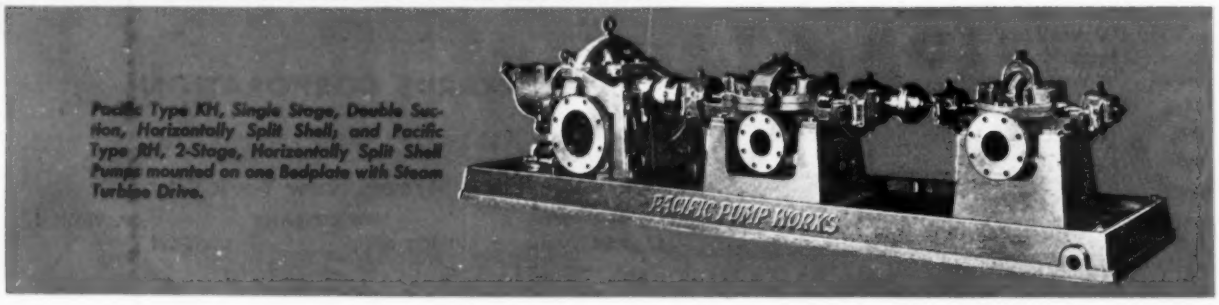
Pacific Type OY, 2-Stage, Ver- tically Split, Centrifugal Pump.



Pacific Type DMB, Single Stage —Double Suction—Horizontally Split, Centrifugal Pump.

PACIFIC PUMP WORK

EXECUTIVE OFFICES & PLANT: HUNTINGTON PARK, CALIFOR
EXPORT OFFICE: 30 ROCKEFELLER PLAZA, NEW YORK C
SALES AND SERVICE: OFFICES IN PRINCIPAL CITIES IN THE UNITED STA
AFFILIATED COMPANIES: DRESSER MFG. CO., BRADFORD, PA., CLARK BROS. CO. OLEAN, N. Y., BRYANT HEATER CO., CLEVELAND, O.

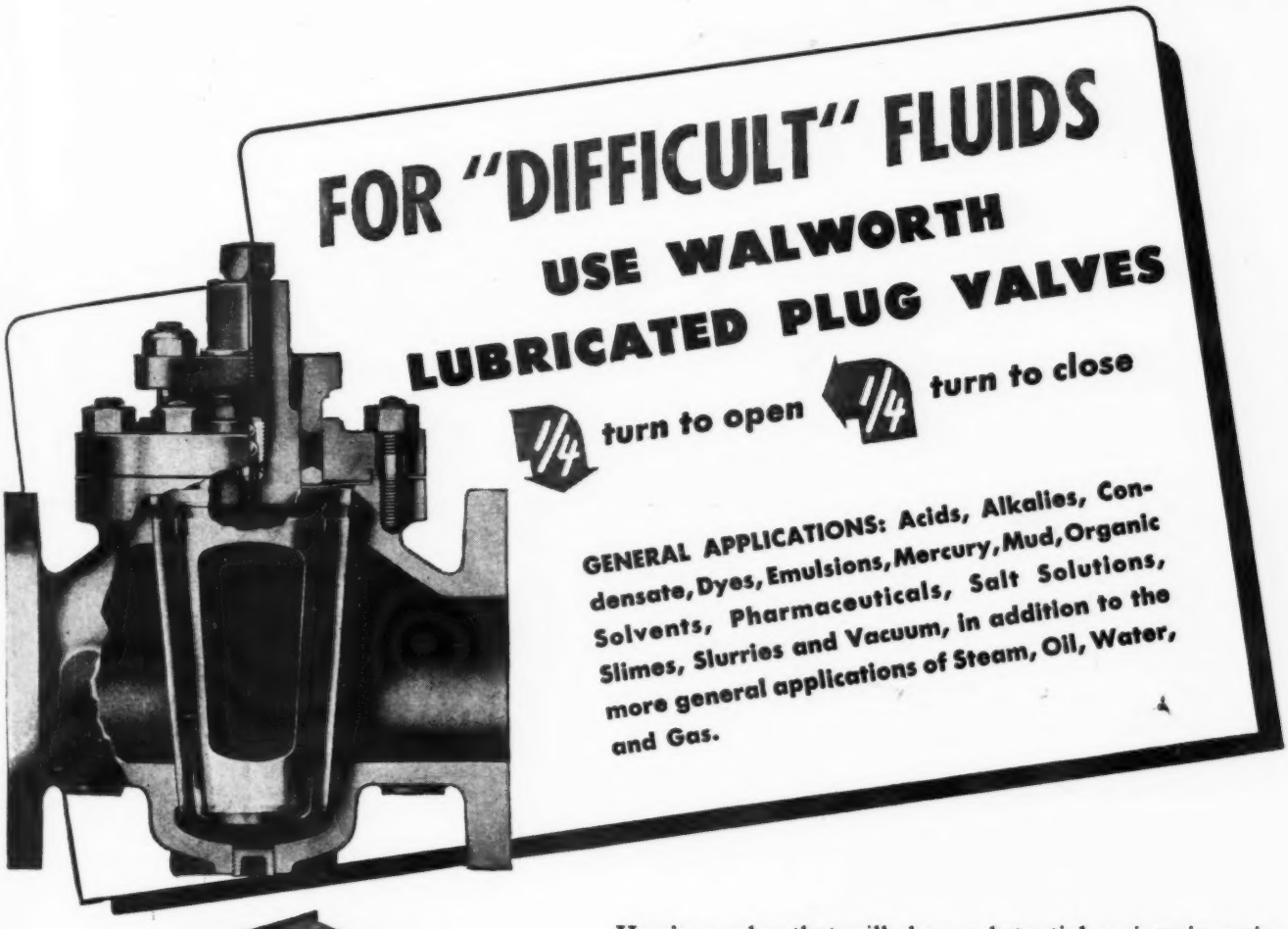


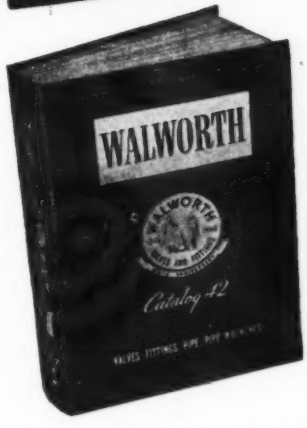
Pacific Type KH, Single Stage, Double Suction, Horizontally Split Shell, and Pacific Type RH, 2-Stage, Horizontally Split Shell Pumps mounted on one Bedplate with Steam Turbine Drive.

PACIFIC PUMP WORKS PACIF HUNTINGTON CALIF.

PACIFIC *Engineered* PUMPS

FIT THE VALVE TO THE SERVICE


FOR "DIFFICULT" FLUIDS
USE WALWORTH
LUBRICATED PLUG VALVES
1/4 turn to open
1/4 turn to close
GENERAL APPLICATIONS: Acids, Alkalies, Condensate, Dyes, Emulsions, Mercury, Mud, Organic Solvents, Pharmaceuticals, Salt Solutions, Slimes, Slurries and Vacuum, in addition to the more general applications of Steam, Oil, Water, and Gas.



To help you "fit the valve to the service" you'll find pertinent information on Walworth's complete line of valves, fittings, pipe, and pipe wrenches in the new Walworth Catalog 42. Included are 78 pages of practical engineering data that simplify valve selection and make piping layouts easier. Write, on business stationery, for your free copy. Address: Walworth Company, 60 East 42nd Street, New York, N. Y. Department 65.

Here's a valve that will show substantial savings in maintenance and replacement costs on those tough services where the conventional type of valve doesn't stand up.

Walworth Lubricated Plug Valves are of the plug cock type, using insoluble lubricants. Easy operation, tight sealing, and resistance to corrosion and wear are assured by simply turning down the lubricant screw. Pressure, hydraulically exerted on the entire lubricant system, automatically frees the plug from its seat, coats the finished surfaces with a film of protective non-friction lubricant, and seals the ports against leakage.

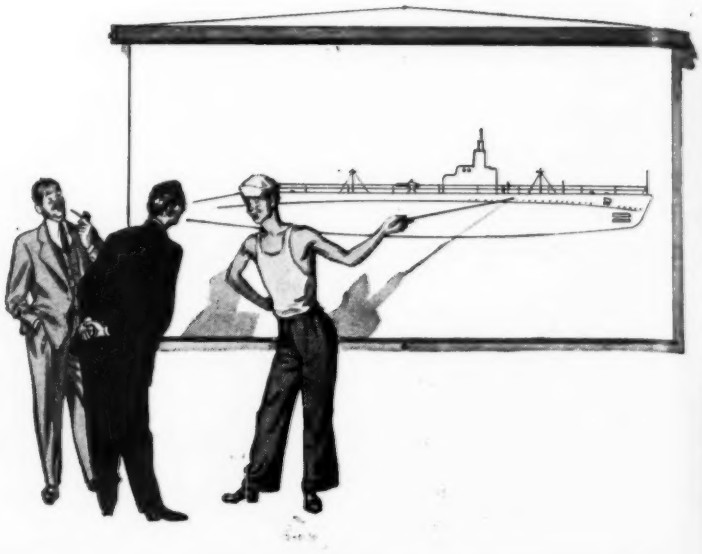
Although generally an all-purpose valve, Walworth Lubricated Plug Valves are especially adaptable to "difficult" services. Available in sizes from ½ to 24 inches, for pressures from 125 to 5,000 psi, and for all vacuum requirements. They are designed to help you *fit the valve to the service.*

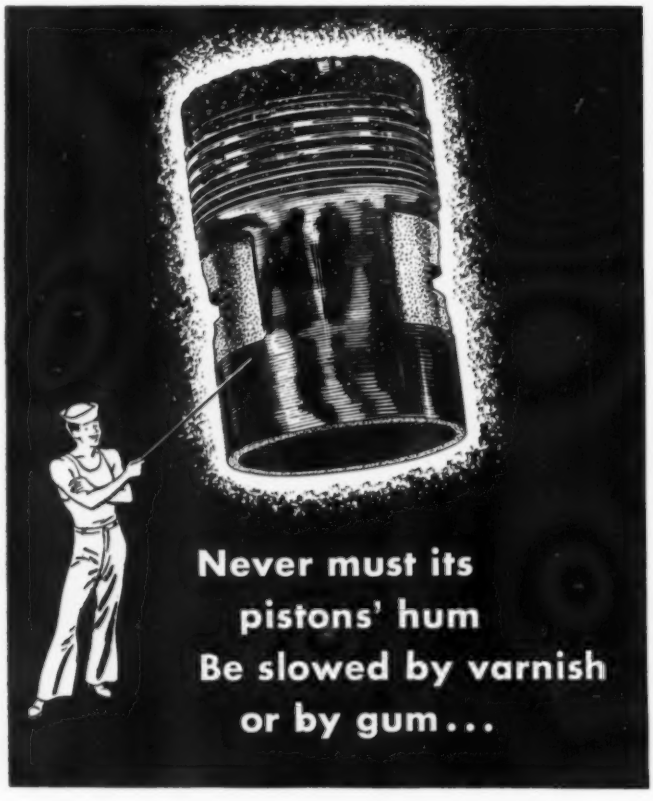
BOSTON WORKS
KEWANEE WORKS

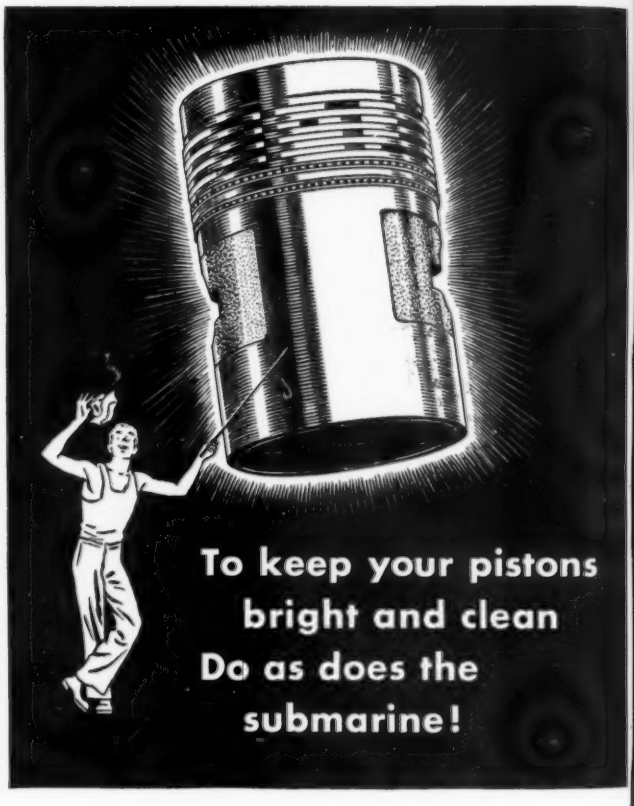
WALWORTH
valves AND fittings

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

This submarine of the U. S. fleet Must keep its Diesels running sweet . . .







. . . use RPM DELO, used by the United States Navy to lubricate the powerful Diesels in our submarines and other warships.

These drawings, from actual photographs in our files, reveal the difference between two pistons, each run 846 hours in a test. One was lubricated with the finest straight mineral oil available, yet its rings were stuck with gum and the skirt was varnished.

The other, lubricated by RPM DELO, was protected by the non-corrosive, anti-oxidant properties that make "RPM" the world's finest Diesel oil. Put RPM DELO to the test in your own Diesels. You, too, will see how it retards ring-sticking and varnishing.

RPM DELO

ORDER RPM DELO FOR YOUR DIESELS

RPM DELO is marketed under the following names:

RPM DELO • Caltex RPM DELO • Kyso RPM DELO
Signal RPM DELO • Imperial-RPM DELO • Sohio RPM DELO
CONCENTRATE

Ask your Diesel engine manufacturer or distributor for the RPM DELO supplier in your vicinity

STANDARD OIL COMPANY OF CALIFORNIA

Bartlett-Snow Coal Handling Equipment Meets *Every* Central Station Requirement

● The equipment is adapted for receiving coal by rail, over waterways or even by automobile trucks . . . to storing and reclaiming coal . . . and handling several sizes and analyses separately, without mixing them. It handles run-of-mine or crushed coal, or permits crushing of the coal during its travel from the receiving point to the stoker. The equipment can be wholly exposed to view from the outside of the building, or partially, or wholly enclosed to permit the building to conform to any architectural appearance.

Bulletin No. 83, just completed, gives full details of Bartlett-Snow Central Station Coal Handling equipment. It describes and illustrates standard and special designs of feeders, conveyors, trippers, chutes, etc., each thoroughly proven in central station service, and the skip hoists which are coming into increasing favor in cases where ground space is limited.

A trial order will convince you what a satisfaction it is to get—from Bartlett-Snow—equipment that has been designed and built specially to meet the rigors of central station service.

Let us quote on your requirements.

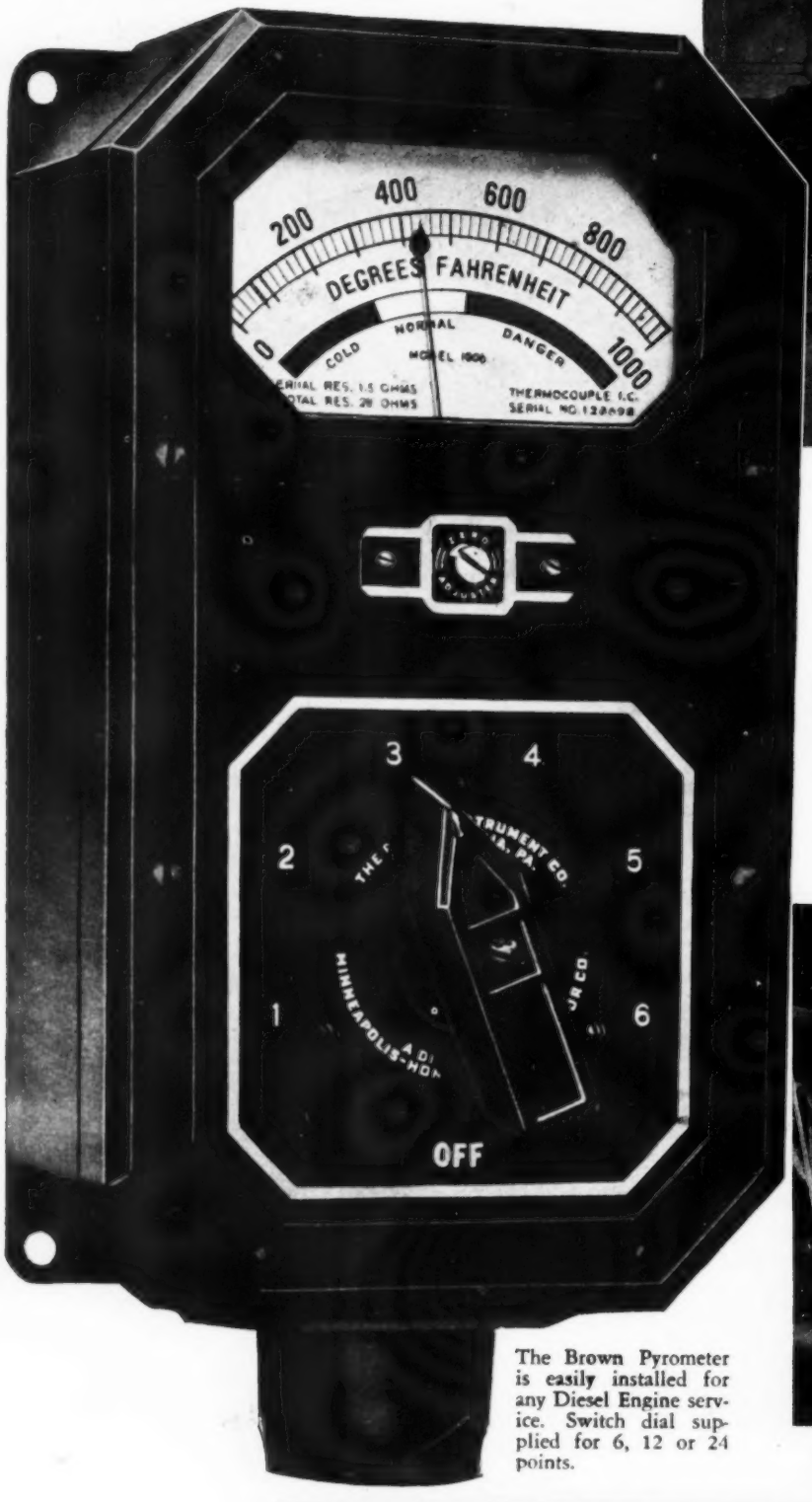
THE C. O. BARTLETT & SNOW COMPANY
6205 HARVARD AVENUE • CLEVELAND, OHIO
NEW YORK • CHICAGO • BALTIMORE • DETROIT • DES MOINES

Bulletin No. 83, describes and illustrates typical Central Station installations. Send for a copy.

BARTLETT·SNOW
Coal and Ash Handling Equipment

TRACK HOPPERS • BELT CONVEYORS • BELT TRIPPERS • SKIP HOISTS
BUNKERS • WEIGH LARRIES • CHUTES • ASH HOPPERS • FIELD STORAGE

Exhaust temperatures of four Fairbanks Morse Diesels are accurately measured by Brown Pyrometers.



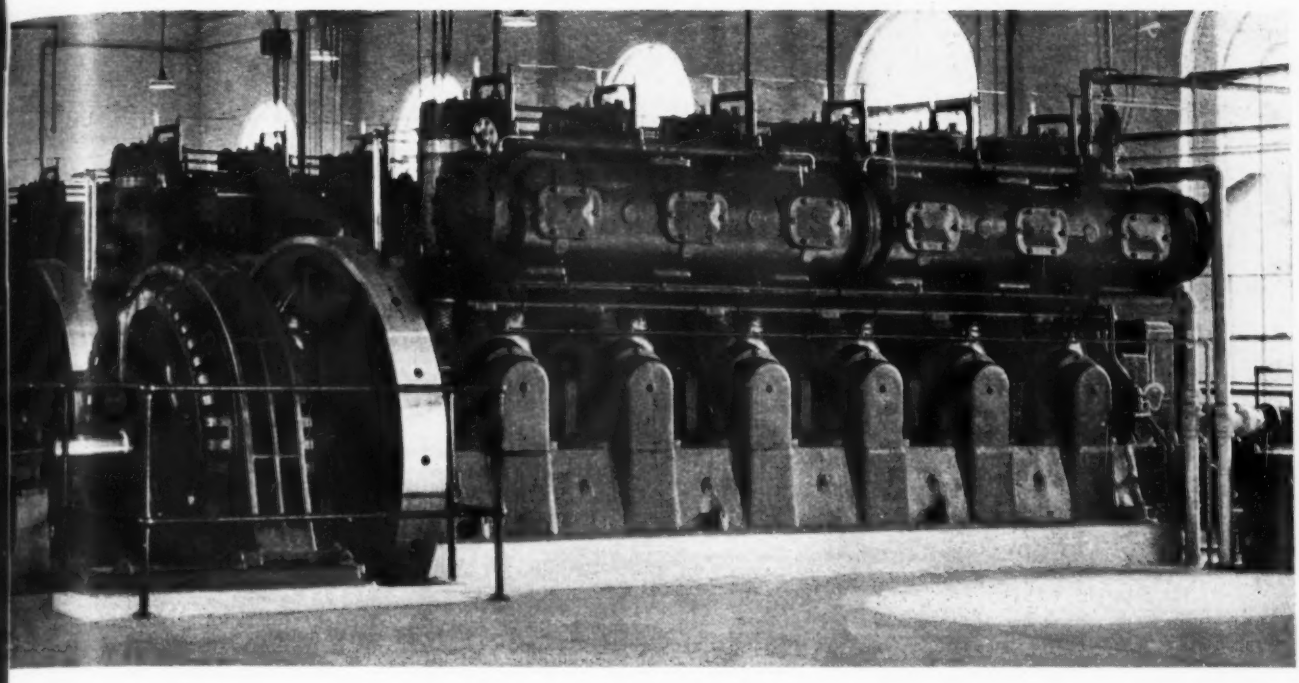
The Brown Pyrometer is easily installed for any Diesel Engine service. Switch dial supplied for 6, 12 or 24 points.

Right: Brown Diesel Thermocouple for short immersion.

Below: Brown Diesel Thermocouple for long immersion

Brown Thermocouples in Cylinder Exhaust Headers of a 6 cylinder Diesel Engine.

BROWN DIESEL E



MAXIMUM EFFICIENCY IS ASSURED

at Prince William Electric

WHEN the Prince William Electric Cooperative put into service its new $200,000 Diesel generating plant, one of the major Rural Electrification Projects of the East was brought a long step toward completion.

In selecting and arranging equipment, nothing was spared to make this plant a model of efficiency and ease of operation.

Each of the four Fairbanks Morse Diesels are equipped with Brown Diesel Pyrometers for checking exhaust temperatures.

A simple turn of the switch—a glance at the clear open dial—and instantly operators have an accurate check on the measurement of the load and relative efficiency of each cylinder. Clearly marked, colored zones on the dial indicate whether temperature is high, normal or low.

Compact and light in weight, the Brown Diesel Engine Pyrometer is built for rugged service — unaffected by vibration or adverse atmospheric conditions. The switch contacts are extra large to withstand hard usage.

Wherever Diesel Engines are used — in industry — in transportation — on the sea — in the air, Brown Pyrometers have earned the preference of exacting engineers and the leading builders of Diesel Engines, because of their accuracy, simplicity, ruggedness and dependability.

The saving in fuel alone has repaid the investment for Brown Pyrometers in many cases.

THE BROWN INSTRUMENT COMPANY, 4490 Wayne Avenue, Philadelphia, Pennsylvania, Division of Minneapolis - Honeywell Regulator Company, Minneapolis, Minnesota. Offices in all principal cities. 119 Peter Street, Toronto, Canada. Wadsworth Road, Perivale, Middlesex, England. Nybrokajen 7, Stockholm, Sweden.

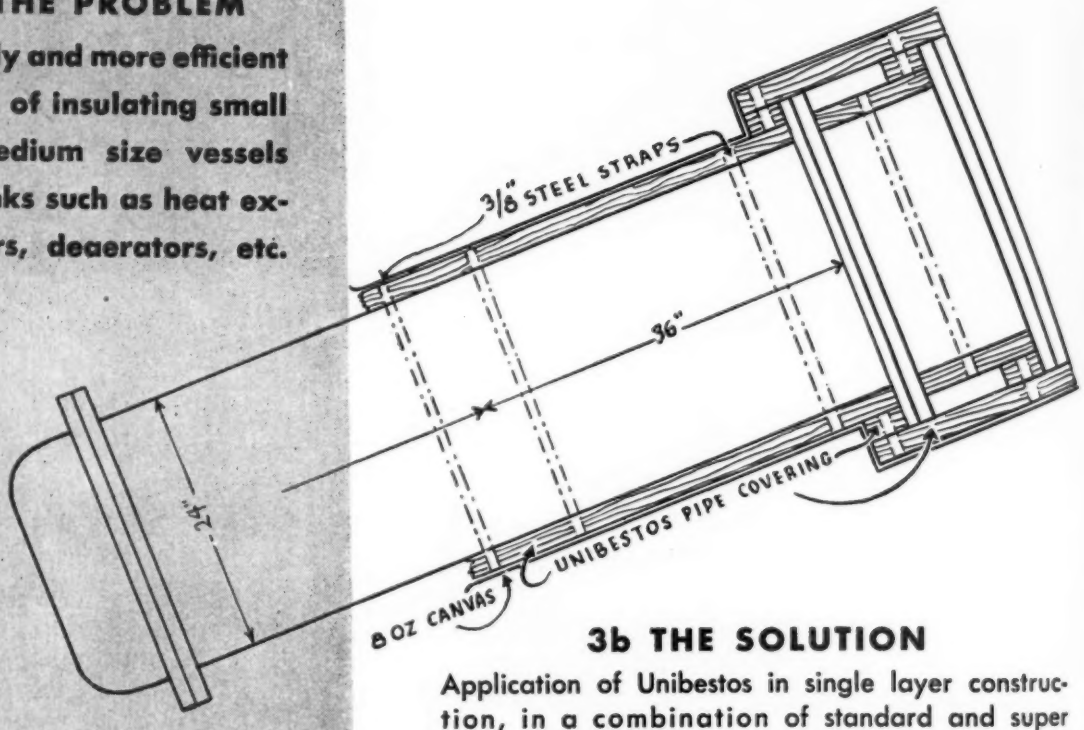
L ENGINE PYROMETER

This is the 3RD in a series of messages

DEALING WITH THE PROBLEMS IN HEAT INSULATION FACED BY ENGINEERS AND SOLVED BY USING UNARCO unibestos

3a THE PROBLEM

A speedy and more efficient method of insulating small and medium size vessels and tanks such as heat exchangers, deaerators, etc.



3b THE SOLUTION

Application of Unibestos in single layer construction, in a combination of standard and super material, of half or quarter sections. This will eliminate the costly and time-consuming method of banding on individual layers in segmental form. Unibestos is applied in large size sections making a quick, easier, more efficient application.

UNIBESTOS is available in Standard material, for temperatures up to 750°; Super, with a temperature limit of 1200°; Combination, with a temperature limit of 1200°. These temperature limits permit the use of one material at maximum efficiency for a wide range of purposes. Unibestos is available in half sections up to 30" pipe diameter and from 32" to 60" in quadrants from ¾" to 5' in thickness. Standard and Super are available in single layer construction with provision for expansion in piping, where required.

INSULATION FOR MARINE, RAILROAD, AVIATION AND INDUSTRIAL USE

TWO ARMY-NAVY "E" AWARDS FOR EXCELLENCE IN WAR PRODUCTION ONE TO THE CICERO, ILLINOIS PLANT; ONE TO THE PATERSON, N. J. PLANT

UNION ASBESTOS & RUBBER CO.

GENERAL OFFICES: 1821 SOUTH 54th AVENUE, CICERO, ILLINOIS • NEW YORK • SAN FRANCISCO • PATERSON, N. J.

No Wasted HOURS OF WATCHING

CASH STANDARD AUTOMATIC COMBUSTION CONTROL SYSTEMS

★ CUT ATTENDANCE TIME

★ BOOST OPERATING EFFICIENCY

★ SAVE COAL . . . OIL . . . GAS

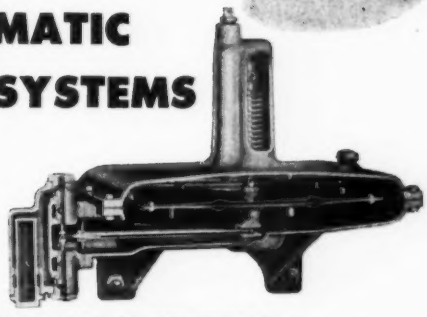
★ PRODUCE MORE HEAT FROM LESS FUEL

★ MAKE BOILERS STRETCH IN CAPACITY

● Attendants in your boiler room won't need to waste valuable time with control of air flow, of fuel feed, nor of draft. It's all done continuously and automatically with CASH STANDARD Automatic Combustion Control Systems . . . in plants as small as 60 h. p. or as large as they come.

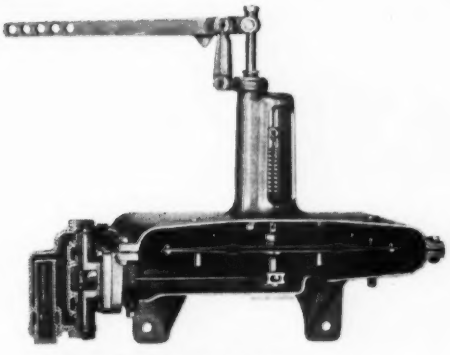
Each unit pictured here is available in numerous variations. Combinations of these units can be selected to best meet your requirements, whether you have a stoker, pulverizer, oil-burning, or gas-firing equipment on your boilers.

Bulletin No. 300 not only gives important details on the performance of each unit, but tells how the system which brings fuel savings and other benefits to your boiler room, can be assembled.



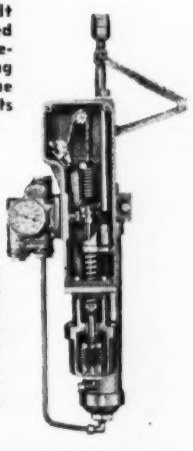
FURNACE DRAFT CONTROLLER

This CASH STANDARD Furnace Draft Controller (which comes complete with Operating Power Cylinder) works from overfire draft, regulating the boiler uptake damper to maintain a constant draft in the combustion chamber.



AIR FLOW CONTROLLER

This CASH STANDARD Air Flow Controller meters the air needed for combustion. Install it near its damper. It is not affected by changes in fuel bed resistance or any other variables, because it meters air supply according to the differential pressure through the gas passages of the boiler, doing its part to insure perfect combustion.

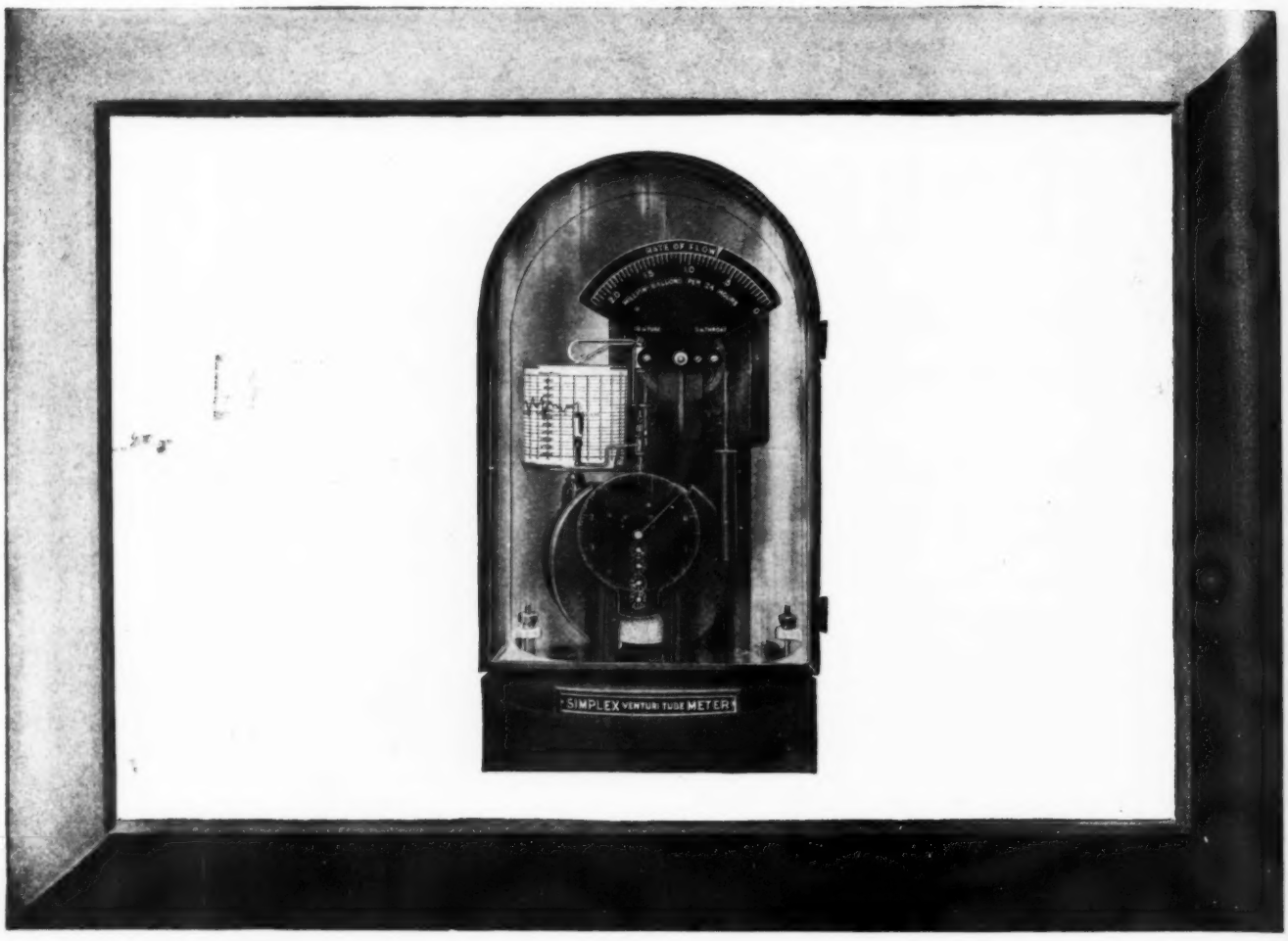


FUEL FEED CONTROLLER

This CASH STANDARD Master Controller automatically regulates fuel feed. Locate it conveniently. Working from boiler pressure, it will adjust the rate of combustion by regulating the rate at which fuel (any kind of fuel) is supplied to the boiler furnace. And it will adjust the Air Flow Controller so the correct amount of air is supplied for proper combustion — hence, money saving.

A. W. CASH COMPANY
DECATUR, ILLINOIS

CASH STANDARD
CONTROLS . . VALVES



Portrait of "A MIND AT EASE"

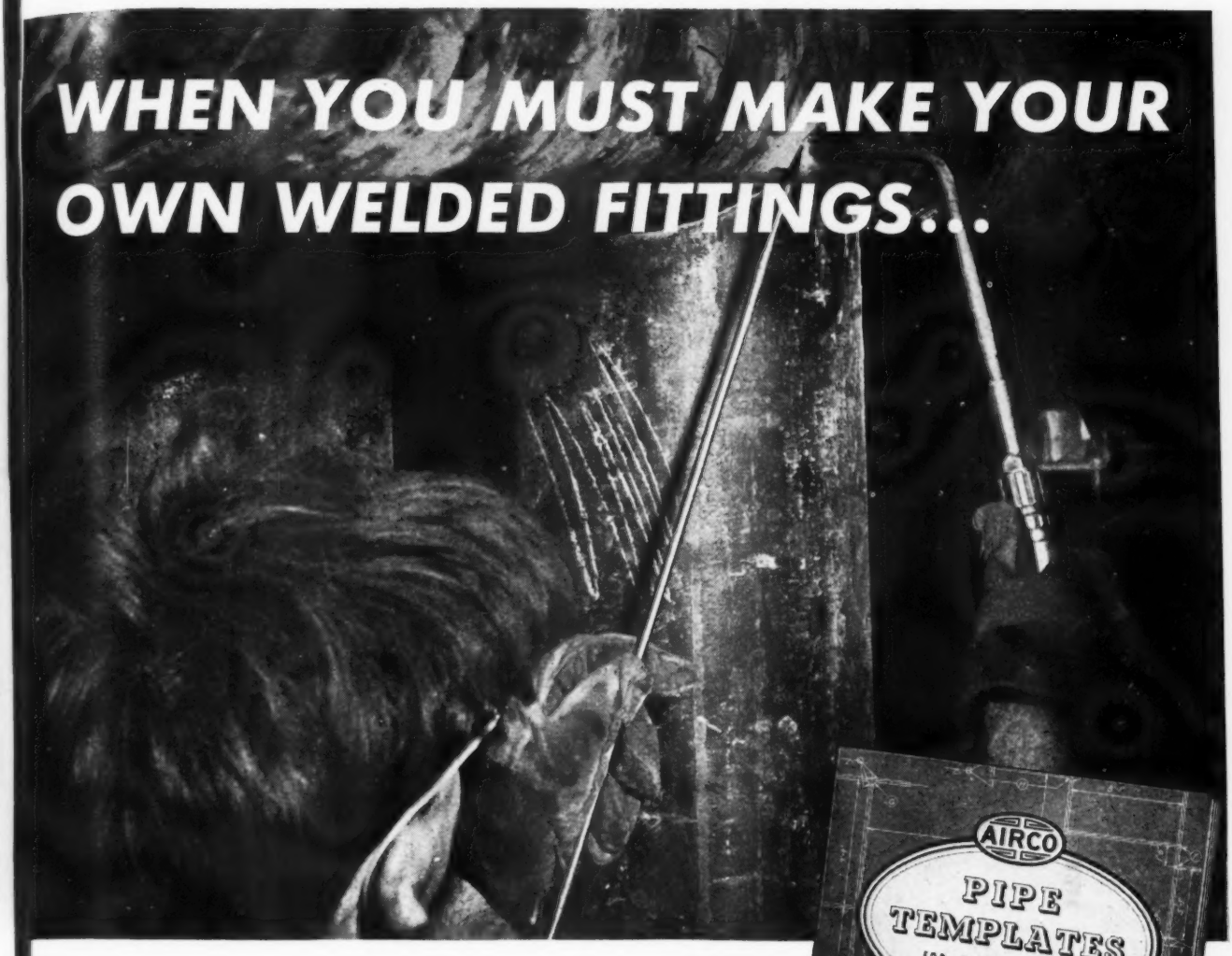
Simplex Type "MO" flow meters have established a reputation for long, dependable service that is taken for granted by thousands of operating men in power plants all over the country.

We receive many comments from new as well as old users telling us of the steady, behind-the-scenes job being done by this "master meter to check all other meters." The "MO" gives unequalled range of flow measurement; extreme sensitivity to the smallest measurable changes in differential head; and an over-all measuring efficiency which takes many a burden from the shoulders of already overworked operating staffs.

The Simplex "MO" meter indicates, records, and totalizes fluid flows with year-round, trouble-free accuracy. We will gladly send you complete information on the "MO" meter. . . . Simply address

SIMPLEX VALVE & METER COMPANY
6780 UPLAND STREET, PHILADELPHIA, PENNA.

WHEN YOU MUST MAKE YOUR OWN WELDED FITTINGS...

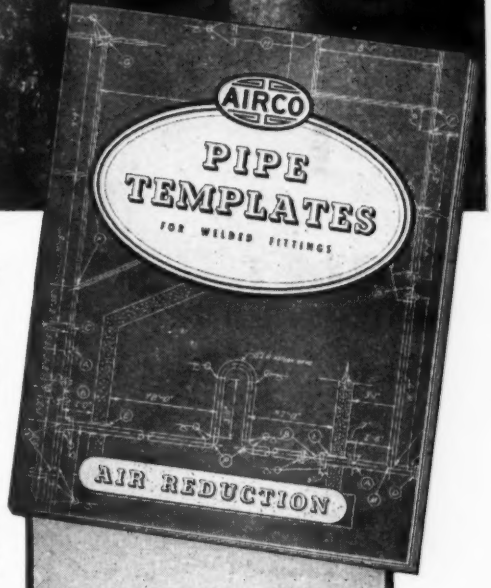


...this NEW Booklet shows you how

When time is short . . . standard welding fittings are not immediately available...and you must make your own—Airco's new booklet "Pipe Templates for Welded Fittings" shows you how. This 12 page illustrated booklet describes how to develop and use templates for fabricating many commonly used welded pipe fittings. A sequence of photographs clearly illustrates the correct flame cutting and welding procedure to be followed.

With the help of this booklet, even relatively inexperienced workers can make accurate pipe connections that are tight fitting and leak proof. Moreover, by eliminating guess-work in fitting up pipe, this booklet saves you valuable time and labor and helps conserve vital materials.

If you work with piping be sure to send for your copy of this booklet today. We will be glad to send you as many free copies as you desire. Please fill out and mail the attached coupon and indicate the number of copies you require.



MAIL COUPON FOR *FREE* COPY

AIR REDUCTION

60 EAST 42nd STREET, NEW YORK, N. Y.

In Texas: Magnolia Airco Gas Products Co.

AIR REDUCTION, Advertising Department R
60 East 42nd Street, New York, N. Y.

Please send me_____copies of the free booklet "Pipe Templates for Welded Fittings."

*Name*_____

*Company*_____

*Address*_____

IDLE CYLINDERS ARE PRODUCTION SLACKERS: KEEP 'EM ROLLING FOR VICTORY!

Old friend arrives . . . Thanks to you

When you're halfway around the world, trying to finish an important job, it's mighty pleasant to greet an old and very helpful friend you used to work with.

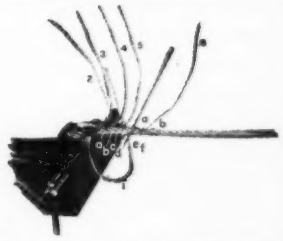
Back home, in scores of industries, the men now on palm-fringed shores learned an affectionate respect for the dependability of Wickwire Rope. Now when stout wire rope is more than ever a matter of life and death, the sight of a reel of *Wickwire* Rope brings double cheers.

These buddies of ours know that *you* need Wickwire Rope, too—to help in your speeded-up *production* of lots of things for them. So they're grateful when you make each length you now have last longer, so that more Wickwire Rope can be used to equip the Liberty Ships, and to send overseas.

But when you do need more of this friendly Wickwire Rope to help maintain your war-production pace, won't you please order it *without* reels, if lengths will permit, so that handier reels can be spared for the boys out there? Wickwire Spencer Steel Company 500 Fifth Avenue, New York.

• • •

Wickwire Spencer was the first manufacturer in all New England to be awarded the Maritime M and Victory Fleet Flag for outstanding production accomplishments!



DO YOUR MEN KNOW HOW?

Our free book "Know Your Ropes" pictures the best ways to splice, attach sockets, etc. Also shows the right and wrong ways to use wire rope. In the hands of new men (and even old-timers) it can help you make your present wire rope last longer. Send for a free copy.

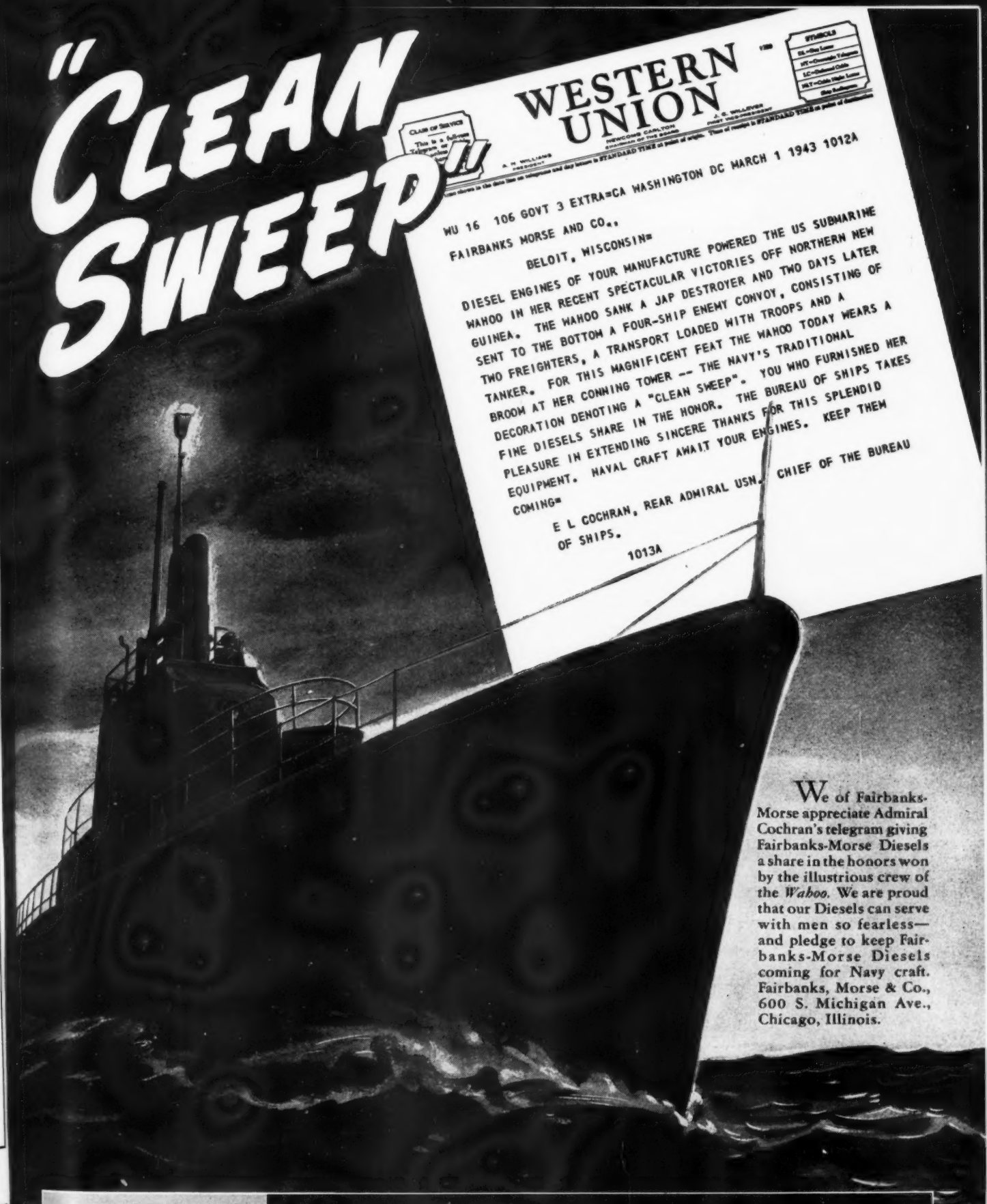
SEND YOUR WIRE ROPE QUESTIONS TO WICKWIRE SPENCER

WICKWIRE ROPE

Sales Offices and Warehouses: Worcester, New York, Chicago, Buffalo, San Francisco, Los Angeles, Tulsa, Chattanooga, Houston, Abilene, Texas, Seattle. Export Sales Department: New York City

WISSCO PRODUCT

"CLEAN SWEEP"


WESTERN UNION
WU 16 106 GOVT 3 EXTRA=CA WASHINGTON DC MARCH 1 1943 1012A
FAIRBANKS MORSE AND CO..
BELOIT, WISCONSIN=
DIESEL ENGINES OF YOUR MANUFACTURE POWERED THE US SUBMARINE WAHOO IN HER RECENT SPECTACULAR VICTORIES OFF NORTHERN NEW GUINEA. THE WAHOO SANK A JAP DESTROYER AND TWO DAYS LATER SENT TO THE BOTTOM A FOUR-SHIP ENEMY CONVOY, CONSISTING OF TWO FREIGHTERS, A TRANSPORT LOADED WITH TROOPS AND A TANKER. FOR THIS MAGNIFICENT FEAT THE WAHOO TODAY WEARS A BROOM AT HER CONNING TOWER -- THE NAVY'S TRADITIONAL DECORATION DENOTING A "CLEAN SWEEP". YOU WHO FURNISHED HER FINE DIESELS SHARE IN THE HONOR. THE BUREAU OF SHIPS TAKES PLEASURE IN EXTENDING SINCERE THANKS FOR THIS SPLENDID EQUIPMENT. NAVAL CRAFT AWAIT YOUR ENGINES. KEEP THEM COMING=
E L COCHRAN, REAR ADMIRAL USN. CHIEF OF THE BUREAU OF SHIPS.
1013A

We of Fairbanks-Morse appreciate Admiral Cochran's telegram giving Fairbanks-Morse Diesels a share in the honors won by the illustrious crew of the *Wahoo*. We are proud that our Diesels can serve with men so fearless—and pledge to keep Fairbanks-Morse Diesels coming for Navy craft. Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Illinois.

FAIRBANKS-MORSE

DIESEL ENGINES
PUMPS
MOTORS
GENERATORS
SCALES
WATER SYSTEMS
FARM EQUIPMENT
STOKERS
AIR CONDITIONERS
RAILROAD EQUIPMENT

Diesels

YOU CAN BANK ON FAIRBANKS

for RENEWABLE Iron Globe, Angle and Cross Valves

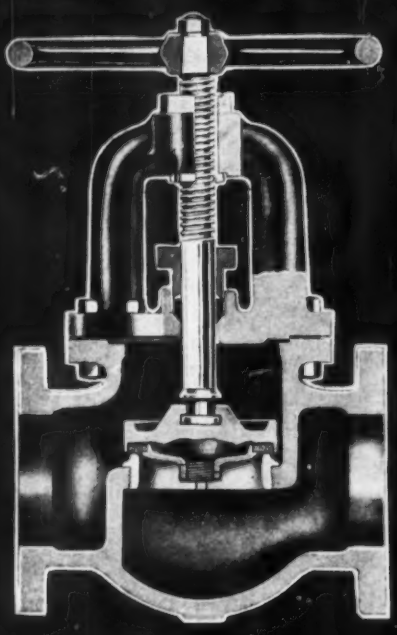


Fig. 0102

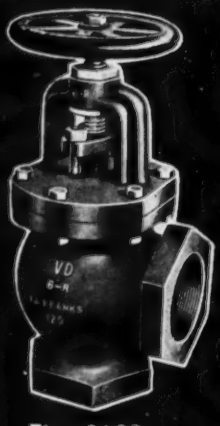


Fig. 0103

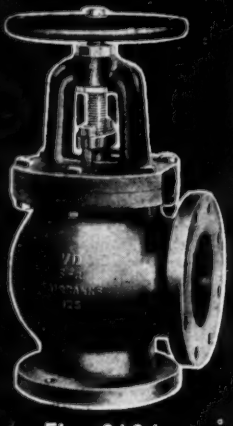


Fig. 0104

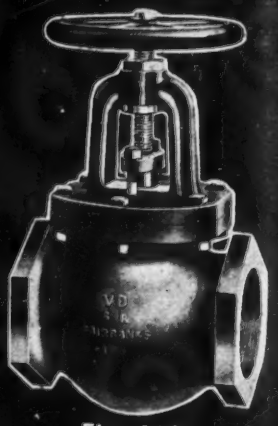


Fig. 0101

OTHER FAIRBANKS VALVES

Bronze Globe, Gate, Angle Cross and Check Valves
Iron Globe, Gate, Angle, Cross and Check Valves
Faircoseal Bronze Valves
U-Bolt Gate Valves
Asbestos Packed Cocks
Bronze Radiator Valves
Sphero Ball Valves

CONSULT FAIRBANKS NEW CATALOG No. 42 FOR DETAILS

They Guard Against Interruptions of Service Due to Valve Failure

SERVICE: Recommended for service on steam, water, oil, gas and air lines. Available for steam working pressures from 125 to 200 lbs.

TYPES: Fairbanks *Renewable* Iron Valves are made with Bolted Bonnets, Rising and Non-Rising Stems, and have Composition Discs or Bronze Seat Rings.

FEATURES: The Seat Rings and Discs can be easily and quickly renewed when worn, without removing the valve from pipe line, at a small fraction of the cost of a new valve. Bodies and Bonnets have an average tensile strength of 38,000 lbs. per sq. in. Stems have *Acme* cut threads and are of generous proportions for strength and easy operation. Stuffing box is deep and can be repacked under pressure when wide open.

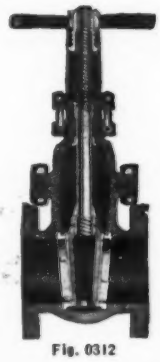


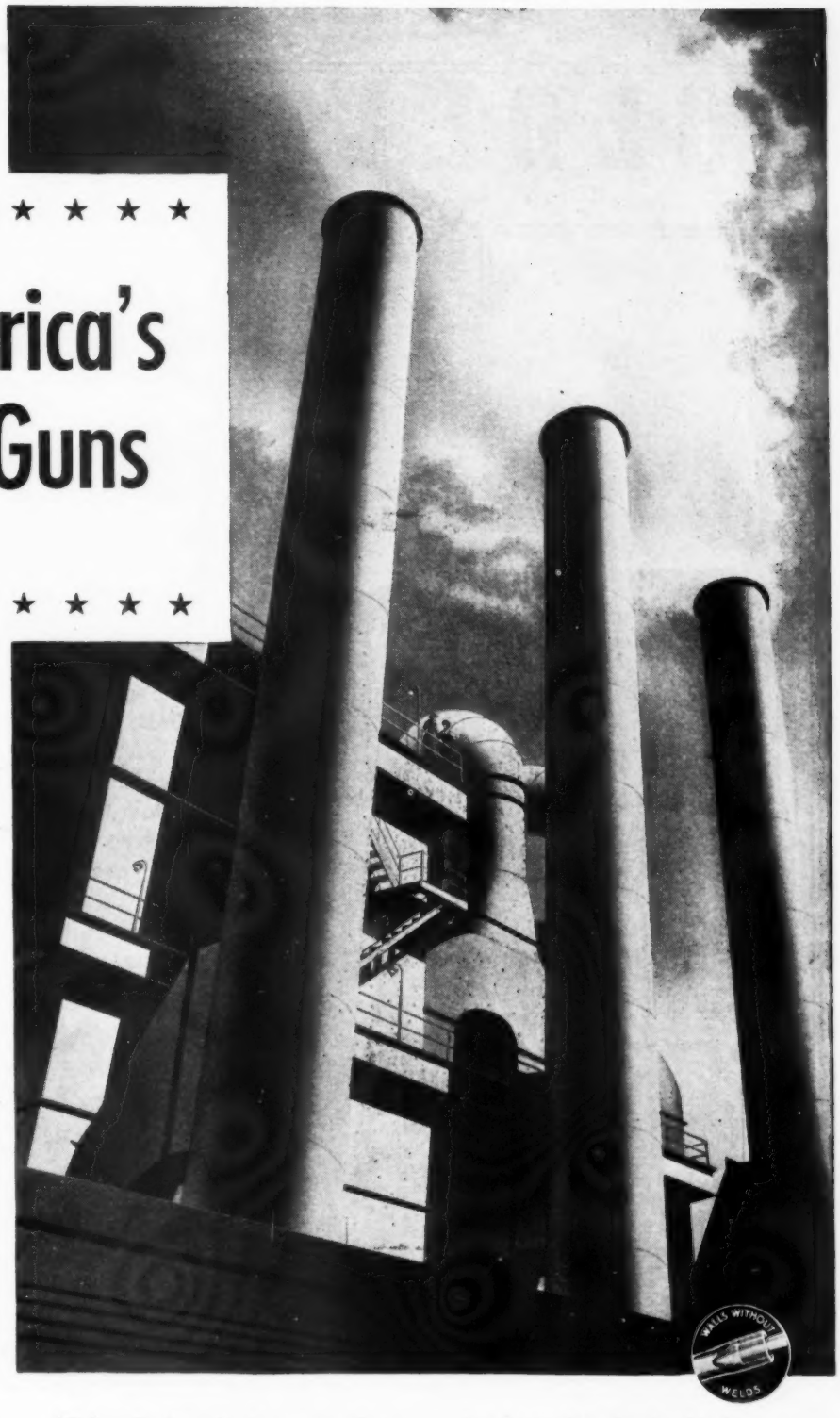
Fig. 0312

THE FAIRBANKS COMPANY

393 LAFAYETTE ST., NEW YORK, N. Y.
BOSTON, MASS. PITTSBURGH, PA.

Distributors in Principal Cities

Firing America's "Biggest" Guns



NO other guns are more important than the smokestacks of industry. Behind each one is hidden the pool of power that helps make America strong. New war plants have strained the capacity of public utilities, and increasing loads have been thrown on industrial power plants.

While better boiler design and other improved plant equipment are playing an important part in keeping boilers on the job, the major responsibility for continuous operation rests upon the boiler tube. Today, boiler tubes are "more precious than gold" . . . and the plant equipped with NATIONAL Seamless Tubes has a better chance to stand up as the going gets tougher. Why is this true? Because seamless tubes have uniform wall strength throughout. There's no weld or potential source of weakness. Each tube is pierced from the highest quality killed open hearth steel—one homogeneous cylinder, absolutely Walls Without Welds.

In the Nation's leading power plants NATIONAL Tubes are serving for one dominant consideration — maximum production for our fighting forces.

All in all, America's power plants and the men who operate them are doing a grand job in the War Program. They are the mighty force that keep the wheels of industry running—they fire America's "Biggest Guns." Congratulations to Uncle Sam's power industry.

NATIONAL TUBE COMPANY

PITTSBURGH, PA.

Columbia Steel Company, San Francisco, *Pacific Coast Distributors* · United States Steel Export Company, New York

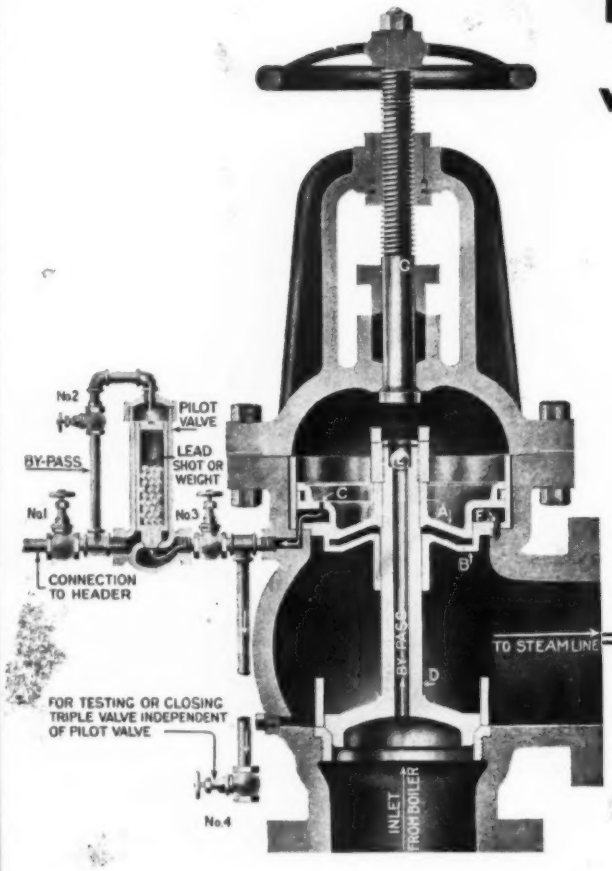
UNITED STATES STEEL

GOLDEN-ANDERSON

SPECIALTY VALVES

For Industry

working under pressure!



● Capacity . . . ability to hold adjusted pressures . . . safe, positive action under strenuous operation—these qualities are inherent in all GOLDEN-ANDERSON Specialty Valves. In service on your water lines and tanks G-A Valves will prove their worth . . . overcome your service troubles and increase the efficiency of your operations. Information on the full line of GOLDEN-ANDERSON Specialty Valves is readily available . . . write, wire or phone today!

GOLDEN-ANDERSON TRIPLE-ACTING NON-RETURN VALVE

● In the event that a high pressure line breaks . . . if a tube blows in one boiler of a battery, the whole battery will explode through the ruptured point, unless you have the automatic life and property protection of the G-A Triple-Acting Non-Return Valve.

Because it is triple-acting, it automatically cuts in a boiler whenever boiler pressure equals line-header pressure. It isolates a boiler automatically, whenever its pressure, from any cause, is lower than line-header pressure. It prevents steam flow from boiler, if there is a sudden drop of line-header pressure below the boiler pressure.

These valves are regularly furnished in Angle, Globe and Elbow patterns; sizes from 2½" to 12" . . . also available in larger sizes as well as in the Cross pattern.

The G-A line includes Altitude Valves, Emergency Stop Valves, Steam and Water Pressure Reducing Valves, Check Valves, Float Valves, etc.

GOLDEN-ANDERSON VALVE SPECIALTY CO.

FULTON BLDG. • • • PITTSBURGH, PA.

OUR JOB FOR 1943

Our first "order of the day" during 1943 is — PRODUCE MORE AUTOMATIC CONTROL EQUIPMENT for the merchant marine, the navy, the synthetic rubber and aviation gasoline programs, and other critical war-time requirements. Fisher Automatic Controls occupy a key position in the fulfillment of these and many other war production schedules.

This equipment is necessarily receiving first attention in our plant — it is a "must" obligation to the production drive for victory. As a result we are unable to make delivery on your orders as quickly as in the past.

However, we have taken definite steps to improve the situation and the results are already apparent. We point with pride to these accomplishments — all aimed at PRODUCING MORE AUTOMATIC CONTROL EQUIPMENT IN 1943!

— INCREASED PRODUCTION —

Already Fisher production is 100% above 1942. Our round-the-clock work schedules call for three eight-hour shifts seven days every week.

— INCREASED PERSONNEL —

Today, the largest working force in the history of our company is constantly striving to produce Fisher Control Equipment in record-breaking quantities. Every member of our organization is mindful of the job that confronts us and is pledged to do something about it.

— INCREASED PLANT FACILITIES —

The entire Fisher Plant is "streamlined" to producing more essential control equipment. More floor space — relocation of departments and equipment have made possible more efficient manufacturing methods as well as greater production.

— INCREASED MACHINE CAPACITY —

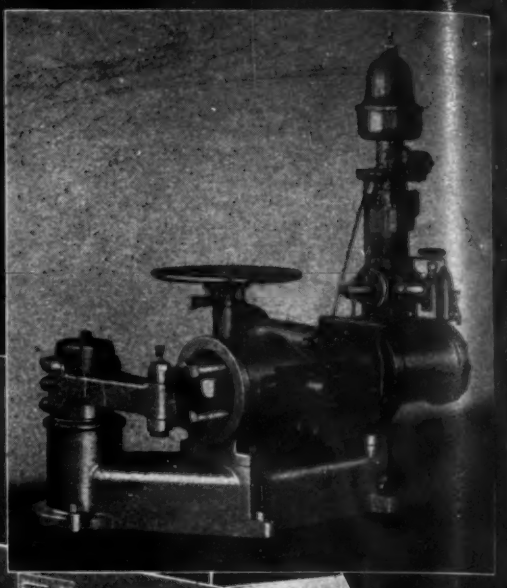
To an already impressive and modern array of manufacturing equipment, many latest design machines have taken their place in Fisher production lines to further speed delivery of automatic controls. Materials and workmanship are maintained to Fisher's high standards.

— SIMPLIFICATION OF TYPES AVAILABLE —

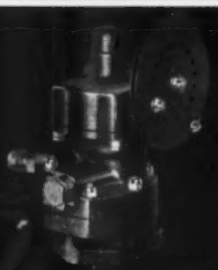
Elimination of many types from the Fisher line for the duration means faster delivery on standard types. Should you order a discontinued item, we ask your co-operation in accepting the recommended standard design . . . remembering that Fisher guarantees satisfactory performance regardless of the substitution.

FISHER GOVERNOR COMPANY
• 426 FISHER BUILDING •
MARSHALLTOWN, IOWA

WOODWARD
PRECISION GOVERNING



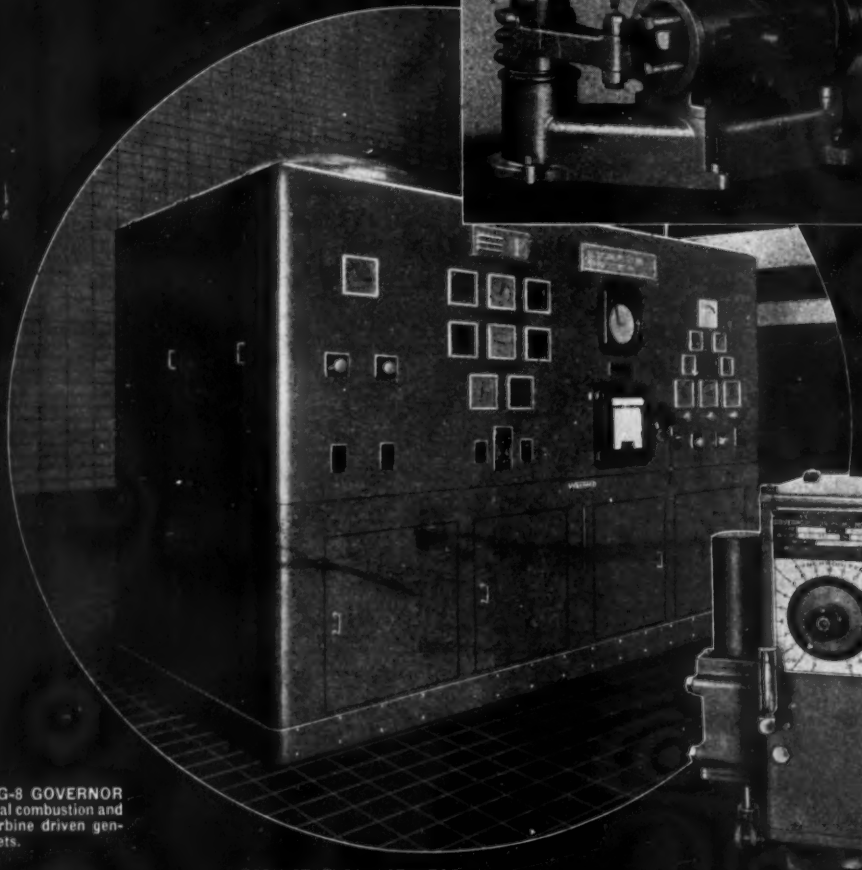
TYPE HR GOVERNOR
for small and medium size hydraulic turbines.



AIRPLANE GOVERNOR
for controlling the pitch of propellor blades.

TYPE SG-X GOVERNOR
for small internal combustion engines.

TYPE UG-8 GOVERNOR
for internal combustion and steam turbine driven generating sets.



CABINET TYPE ACTUATOR
for large hydraulic turbines.

TYPE SI GOVERNOR
for larger internal combustion engines and wide speed range applications.

WOODWARD Governors cover the entire speed control field for the Armed Forces. In the air — on the sea — all forms of land transportation and power.

WOODWARD research is continually working on many new governor designs and applications for both the war effort and future use.

WOODWARD GOVERNOR COMPANY

WORLD'S OLDEST AND LARGEST EXCLUSIVE MANUFACTURER OF HYDRAULIC GOVERNORS FOR PRIME MOVERS

ROCKFORD, ILLINOIS

Power FOR THE MACHINES OF VICTORY—THROUGH DODGE-TIMKEN TRANSMISSION EQUIPMENT

A modern group drive installation using Dodge transmission units equipped with Timken Bearings.

The group drive as demonstrated by this Dodge-Timken installation, represents an efficient and economical method of utilizing power for machine operation.

By enabling machines to be operated in small groups Dodge-Timken Group Drives permit much shorter line shafts to be used and help to reduce loss of production time due to involuntary shutdowns by (a) greatly curtailing the possibility of line shaft trouble and (b) limiting work stoppage to a few machines in the event such trouble should occur.

Naturally Timken Tapered Roller Bearings contribute materially to these benefits by eliminating friction, simplifying lubrication and minimizing maintenance. Their ability to carry radial, thrust and combined loads and to hold moving parts in correct and constant alignment add greatly to the endurance of any kind of equipment in which they are installed. The Timken Roller Bearing Company, Canton, Ohio.

Stress production for Victory — but don't lose sight of what may follow. Raise the performance standards of your machines now by the use of Timken Bearings wherever suitable; redesign if you have to.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

"ALL THERE IS IN BEARINGS"

WeldELLS have everything ★

"You said it, brother — EVERYTHING!"

His job is *welding;* not fooling around getting ready to weld.

He can put more time on actual welding when he uses WeldELLS:*

—Because their tangents make them easier to line up.

—Because their precision quarter-marked ends simplify layout.

—Because the size and thickness are permanently marked on every fitting.

He can turn out a better job, too, when he uses WeldELLS—thanks to their dimensional accuracy and to the machine tool beveled ends that provide an ideal welding surface.

And the features that mean so much to the welder are also vitally important to the men who engineer the job and those who live with it.

★ No other fittings for pipe welding combine these features found in WeldELLS:

- **Seamless** — greater strength and uniformity.
- **Tangents** — keep weld away from zone of highest stress — simplify lining up.
- **Precision quarter-marked ends** — simplify layout and help insure accuracy.
- **Selective reinforcement** — provides uniform strength.
- **Permanent and complete identification marking** — saves time and eliminates errors in shop and field.
- **Wall thickness never less than specification minimum** — assures full strength and long life.
- **Machine tool beveled ends** — provides best welding surface and accurate bevel and land.
- **The most complete line of Welding Fittings and Forged Steel Flanges in the World** — insures complete service and undivided responsibility.

* WeldELLS and many other Taylor Forge products are produced in Byers Genuine Wrought Iron.

TAYLOR FORGE & PIPE WORKS, General Offices & Works: Chicago, P. O. Box 485

• The list of Taylor Forge's contributions to the war effort only begins with WeldELLS. One of many examples is Taylor Corrugated Marine Furnaces, essential to many merchant ships and transports.

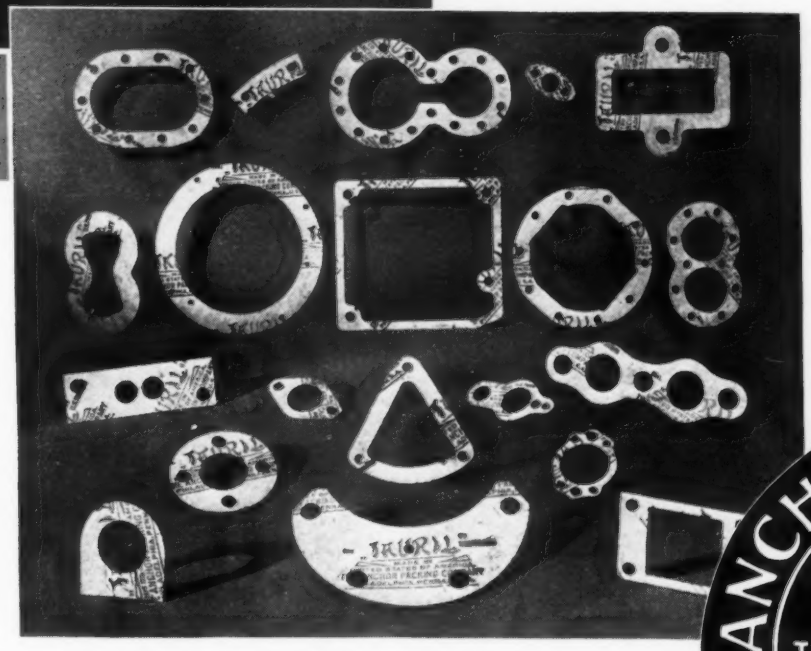
NEW YORK OFFICE: 50 CHURCH ST. • PHILADELPHIA OFFICE: BROAD ST. STATION BUILDING

TAURIL

Reg. U. S. Pat. Off.

THE ULTIMATE IN COMPRESSED ASBESTOS SHEET

TAURIL sheet packing is made under an exclusive process to resist super-heat and high-pressures . . . Thoroughly impregnated long-fibre asbestos is used in the manufacturing of TAURIL . . . As illustrated at left, TAURIL sheet is branded for positive identification, and each sheet carries the Underwriters' Laboratories label. The nearest Anchor Packing expert will be glad to demonstrate the many applications of this superior gasket material.



Note in illustration above that gaskets of all shapes and sizes for both power and chemical services can be cut accurately from this high quality sheet. Furnished in thicknesses of 1/64", 1/32", 1/16" and 1/8". Sheet sizes 50"x50" and 50" x 150".

THE ANCHOR PACKING CO. TRADE A MARK

THE ANCHOR PACKING COMPANY

MANUFACTURERS—DISTRIBUTORS

METALLIC & FIBROUS PACKINGS FOR EVERY PURPOSE

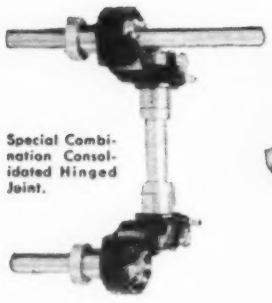
GENERAL OFFICES

PHILADELPHIA, PENNSYLVANIA

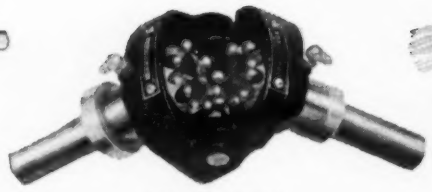
FACTORIES: **MANHEIM, PENNSYLVANIA • ELKHART, INDIANA • MONTREAL, CANADA**

BRANCH OFFICES

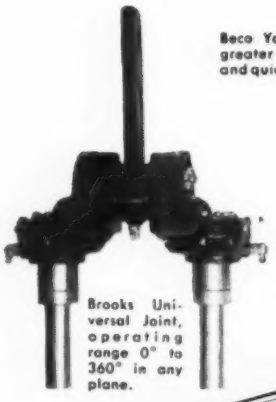
Baltimore, Maryland	106 Stewart Building, Gay and Lombard Streets
Boston, Massachusetts	303-04 North Station Building, 150 Causeway Street
Buffalo, New York	Andrews Building
Cleveland, Ohio	523-25-27 Rockefeller Building
Chicago, Illinois	309 East Illinois Street
Cincinnati, Ohio	4 West 7th Street
Detroit, Michigan	169 West Jefferson Avenue
Houston, Texas	509 Washington Avenue
Kansas City, Missouri	1332 Oak Street
Los Angeles, California	720 Mateo Street
Montreal, Canada	5575 Cote Saint Paul Road
Milwaukee, Wisconsin	4417 West North Avenue
New Orleans, Louisiana	418 Common Street
New York, New York	190 Sixth Avenue, near Canal
Philadelphia, Pennsylvania	401 North Broad Street
Pittsburgh, Pennsylvania	405 Penn Avenue
Portland, Oregon	Terminal Sales Building
San Francisco, California	156 South Park
Seattle, Washington	2207 First Avenue, South
St. Louis, Missouri	1407 Pine Street
Tulsa, Oklahoma	823 South Gary Place
Wilmington, California	207 Avalon Boulevard



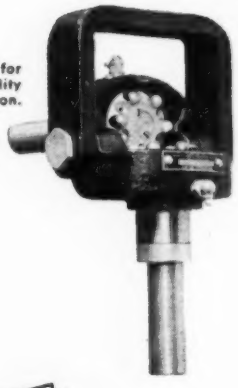
Special Combination Consolidated Hinged Joint.



Consolidated Hinged Joint, Model A, operating range 0° to 90°.



Brooks Universal Joint, operating range 0° to 360° in any plane.



Beco Yoke Bracket for greater joint flexibility and quicker installation.

How to Solve Problems of REMOTE CONTROLS

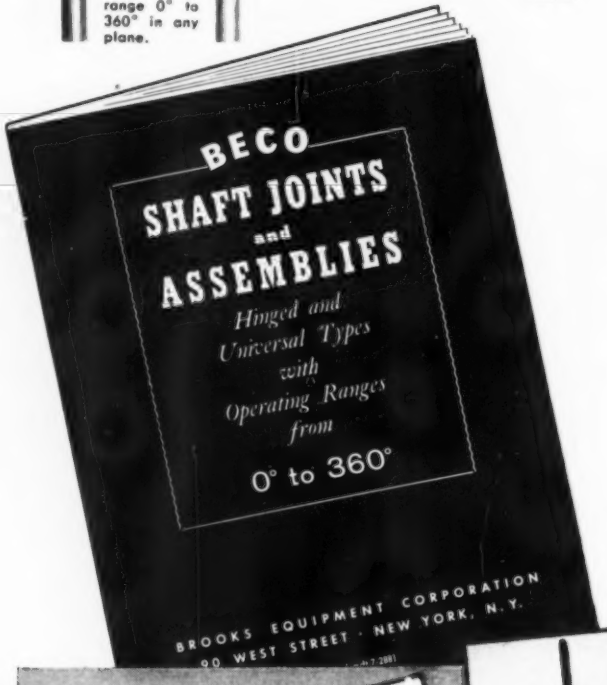
- Operating Gears
- Engine Controls
- Steering Controls
- Valve Controls
- Shaft Couplings
- Expansion Couplings
- Shaft Joints
- Shaft Hangers

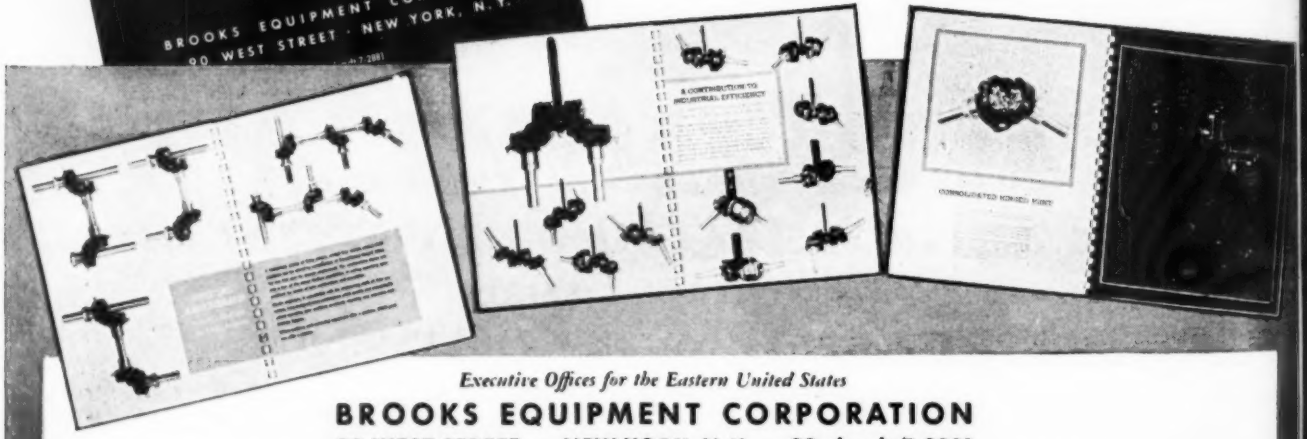
Shaft joints and assemblies engineered by the Brooks Equipment Corporation have broken through the limitations of ordinary universal joints and bevel and mitre gears.

This new Brooks handbook will provide a solution to any remote control problem you face — assuring quicker, simpler, more economical installations in applications formerly requiring complicated and expensive layouts. The catalog section covers the complete Brooks line of shaft joints and assemblies hand operated at low R. P. M. and a full line of accessories.

The Brooks catalog contains 48 pages of vital information to every engineer, designer and operator concerned with remote controls.

Registered copies of this new and important book are now available. They will be sent on request as long as they last. Send for your copy today.





Executive Offices for the Eastern United States

BROOKS EQUIPMENT CORPORATION

90 WEST STREET · NEW YORK, N.Y. · COrtlandt 7-2881

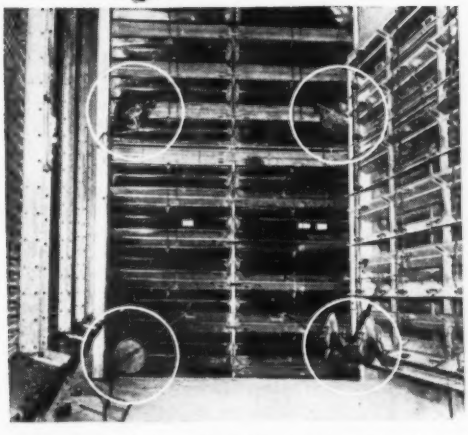
BROOKS EQUIPMENT CORPORATION OF CALIFORNIA

Executive Office and Warehouse	*Branch Office and Warehouse*	*Branch Office and Warehouse*	*Branch Office*
461 Market Street	**717 Second Avenue**	**736 E. Washington Blvd.**	**203 U. S. National Bank Building**
San Francisco, California	**Seattle, Washington**	**Los Angeles, Calif.**	**Portland, Oregon**
Garfield 8542	Main 3569	Prospect 9125	Atwater 0233

APPLICATION OF CONTROL PRODUCES

Efficiency

IN ONE OF AMERICA'S LARGEST BOMBER PLANTS



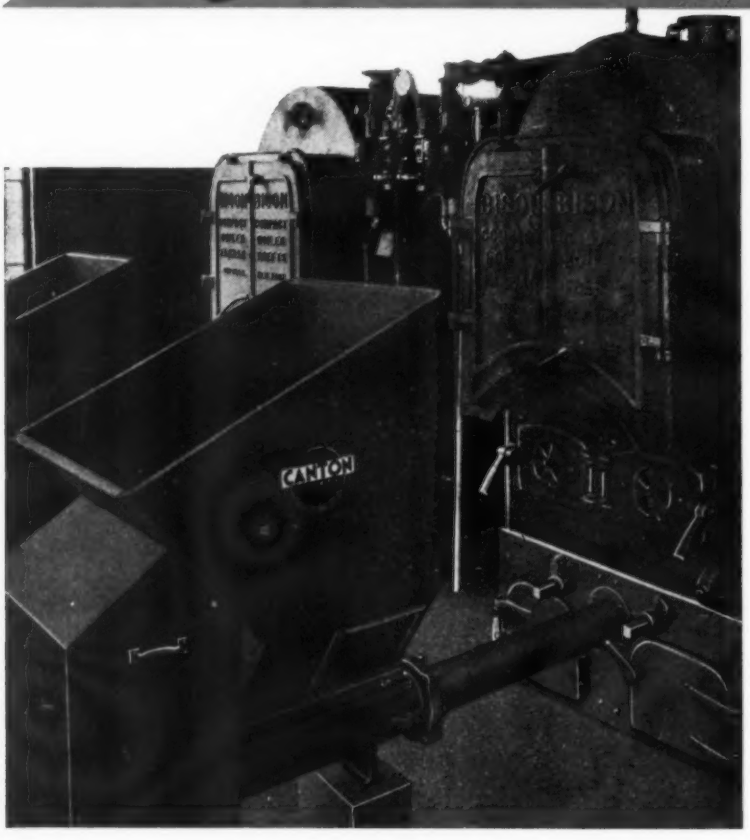
The above photographs show the application of a few M-H Controls and Damper Motors . . . all temperature controls in this, one of the largest and newest of American Bomber Plants, are supplied by Minneapolis-Honeywell . . .

EFFICIENCY is the one factor essential to the attainment of an early victory, a factor of utmost importance for record-breaking war production . . . The manufacture of bomber parts in huge quantities is certainly no exception; the precision demanded of mass aircraft production requires specific, closely controlled atmospheric conditions for personnel and materials . . . M-H Controls help those who help—in this case, all heating and air conditioning control requirements were filled by Minneapolis-Honeywell engineers and equipment. The result: specific and ideal atmospheric conditions at all times. The same efficiency is duplicated from Coast to Coast, wherever M-H Controls are functioning . . . Minneapolis-Honeywell Regulator Co., 2707 Fourth Ave. South, Minneapolis, Minnesota.

MINNEAPOLIS-HONEYWELL

Regulator Company

Canton Stoker GIVES YOU THE ANSWER



DeLuxe Wormfeed Side Dump Stoker installed in a large Chemical Plant.

CONVERSION TO STOKER FIRING WILL - - - SAVE CRITICAL OIL

Help reduce the consumption of vitally needed fuel oil and also increase your capacity to meet the heavier load of 24 hour peak output and plant expansions. Convert to CANTON coal stoker firing. In hundreds of plants where "CANTONS" serve, the records prove lowest steam and maintenance costs. And you'll find these plants with wide variances in operating conditions and a considerable difference in grades of coal burned. Regardless how serious your problem in conversion appears, don't hesitate longer, CANTON stoker firing *can* do your job. Let's look into the facts further . . .

54 TYPES AND SIZES OF "CANTONS" TO SERVE YOUR NEEDS EFFICIENTLY AND ECONOMICALLY.

One reason CANTON can simplify your successful oil conversion is the completeness of its engineered line—54 types and sizes provide the right stoker for the smallest need right up to requirements for developing 800 H.P. or more. Here is a brief summary of CANTON types.

Vulcan Industrial Ramfeed—Specially designed for heaviest loads—18 sizes and types.

Lo-Set Industrial Ramfeed—18 sizes and types engineered for medium industrial and heavy commercial applications.

DeLuxe Industrial Wormfeed—A group of 10 sizes and types for lighter industrial and medium commercial demands.

Standard Commercial Wormfeed—Designed for lighter commercial installations—8 sizes and types.

CANTON Synchronized Controls—For automatically varying coal feed, forced draft and boiler draft to follow steam demand.

A FEW FAMOUS NAME CANTON USERS

Bell Aircraft Corp. - - -	Niagara Falls, N. Y.
Otis Elevator Company - - - -	Buffalo, N. Y.
Republic Steel Corp. - - - - -	Pikeville, Ky.
Electro Metallurgical Corp. -	Niagara Falls, N. Y.
Abrasive Machine Tool Co. -	E. Providence, R. I.
Ferro Enamel Corp. - - - -	Cleveland, Ohio
Shoreham Hotel - - - - -	Washington, D. C.
Rhode Island State College - -	Kingston, R. I.
Fairmont Dye Works - - -	Woonsocket, R. I.
Collyer Insulated Wire Co. - -	Pawtucket, R. I.
U. S. Dept. of Agriculture - - -	Beltsville, Md.

CANTON STOKER

32 years OF "KNOW HOW"

REPRESENTATIVES IN PRINCIPAL CITIES

- - - TO SPACE AND OIL CONSERVATION PROBLEMS!

A CANTON RAMFEED WITH UNIFLEX DRIVE WILL - - -

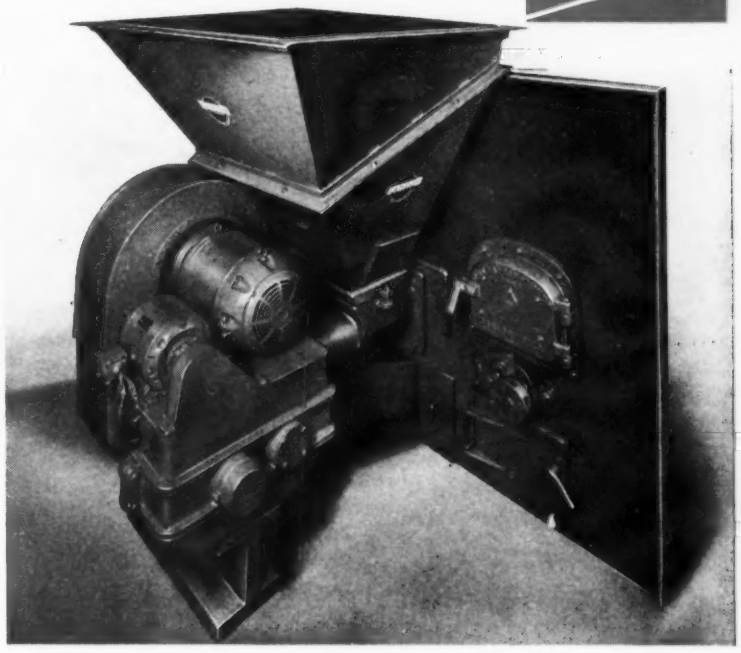
SAVE VALUABLE SPACE

Numerous plants throughout States with minimum oil rationing have chosen CANTON Ramfeeds with UNIFLEX drive because of space problems. The UNIFLEX drive, available on all Ramfeed models, was particularly engineered for installations in limited space. The simplified design of front motor mounting and compact arrangement makes possible the easy adaption to equipment formerly oil fired. Many additional advantages accrue also with CANTON Ramfeeds with UNIFLEX—of chief importance today is the high overload capacities they will deliver, overratings up to 200% are easily carried. In the illustration at the right note the separate fan drive which gives advantageous flexibility, also note the accessibility of oversize doors and clean out panel. The side ash dumping plates are gear operated.

EASY COST SAVING WAY— NO SLOW AND EXPENSIVE STRUCTURAL CHANGES

Speed of conversion at lowest cost can be obtained because CANTON Ramfeeds' design permits rapid installation—all necessary operations completed in the front, and it only requires shallow ashpits at boiler-room floor level. Yes, when you investigate all the facts and check the long list of money-saving features, it's no wonder so many hundreds of prominent plants have gone "CANTON". A survey and analyzation of your problem by a CANTON engineer will quickly disclose the benefits CANTON offers.

MAIL THE COUPON TODAY FOR COMPLETE DESCRIPTIVE DATA

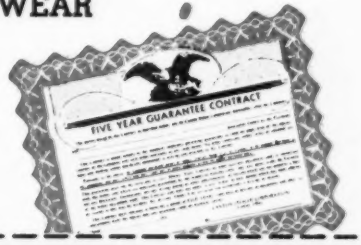


CANTON UNIFLEX RAMFEED STOKER

AND GUARANTEED TOO!

AGAINST DEFECTS AND WEAR FOR FIVE YEARS

Only CANTON offers such an unusual Bond—additional proof of the in-built ruggedness and durability that merits this guarantee.



CANTON STOKER CORPORATION

741 ANDREW PLACE, S. W., CANTON, OHIO

GENTLEMEN:

------Please send all descriptive literature at once.

------Have a CANTON Engineer interview us immediately.

Name----------

Company----------

Address----------

City---------- *State*----------

*CARBON

TIDEWATER LUBRICANIA

DEFINITION: The Carbon Residue Test is a means of determining the amount of Carbon which remains after an oil has been evaporated under certain conditions of high temperature and under exclusion of air.

TEST (Conradson Carbon Residue): Following a carefully prescribed procedure with standardized equipment, a sample of the oil is heated and the oil vapors allowed to burn. After the vapors cease to come off the heat is raised for a given period to cause the destructive distillation of the remaining liquid.

The Carbon Residue is the weight of the carbonaceous residue left in the crucible, expressed in percentage of the original weight of the oil.

EXAMPLES:

(% Carbon Residue)	
Nil	Gasoline
Nil	Kerosene
Trace — 0.05	No. 2 Fuel Oil
0.03-0.25	Machine Oils
0.3-1.5	SAE 50 Motor Oil
1.5-4.5	Steam Cyl. Oils

SIGNIFICANCE: The Carbon Residue Test may be important with fuel oils or gas oils used in certain oil burning or gas manufacturing equipment. As an index to carbon forming tendencies of lubricating oils for use in internal combustion engines, it is totally unreliable. The quantity and nature of such engine deposits are greatly influenced by the oxidation susceptibilities of the oil and other factors peculiar to engine operation. Oils high in resistance to oxidation and otherwise most desirable for heavy duty operation often give relatively high Carbon Residue values.

DRUMS! DRUMS! DRUMS!
War needs make it extremely important that all empty drums be returned immediately.

To assure the unvarying high quality of Tycol Products they are rigidly controlled and subjected to all essential tests during manufacture. Tycol lubricants for internal combustion engines are available in different types and grades to meet different conditions of operation. Call upon the Tide Water industrial engineers who will recommend the Tycol product best suited to your problem.

TIDE WATER ASSOCIATED OIL COMPANY

Eastern Division: 17 Battery Place, New York
Principal Branch Offices: Boston, Philadelphia, Pittsburgh, Charlotte, N. C.
MAKERS OF THE FAMOUS VEEDOL MOTOR OIL

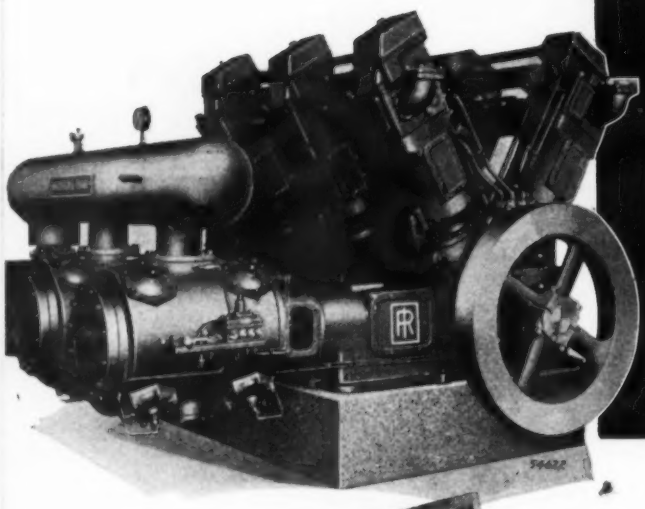
INDUSTRIAL TYCOL OILS-GREASES

SCIENTIFICALLY ENGINEERED FOR EVERY INDUSTRIAL USE **TYCOL**

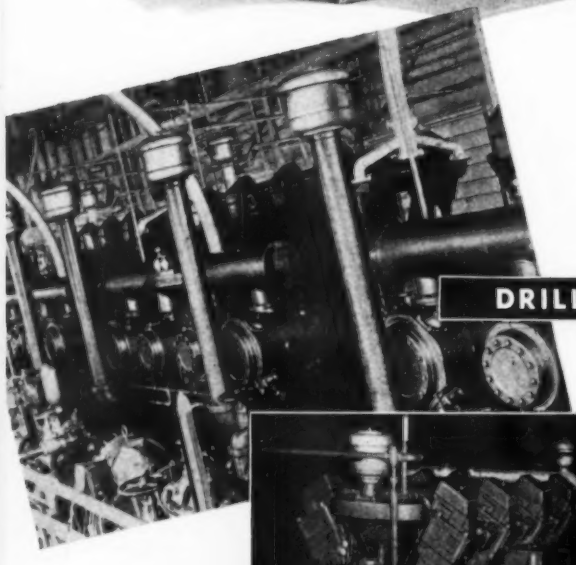
RESIDUE

*This is #4 of a series of informative messages concerning the meaning and significance of commonly used tests and terms employed to describe the characteristics of lubricating oils.

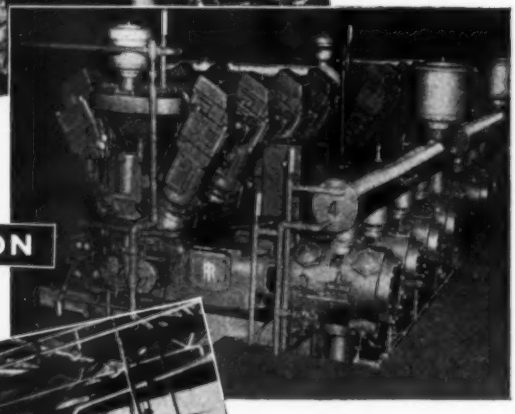
INDUSTRIAL LUBRICANTS



Type XVO DIESEL-POWERED COMPRESSORS



DRILL BOAT



CONSTRUCTION

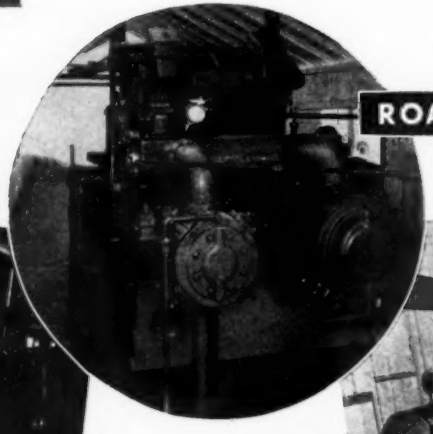
This direct-connected oil engine-air compressor unit burns only one gallon of fuel in compressing 5600 cubic feet of air to 100 pounds pressure. That means 933 cubic feet for 1¢, assuming fuel costs 6¢ per gallon.

Such exceptionally low consumption reflects the advanced engineering features that have been built into this compact 4-cycle Diesel engine and modern air compressor.

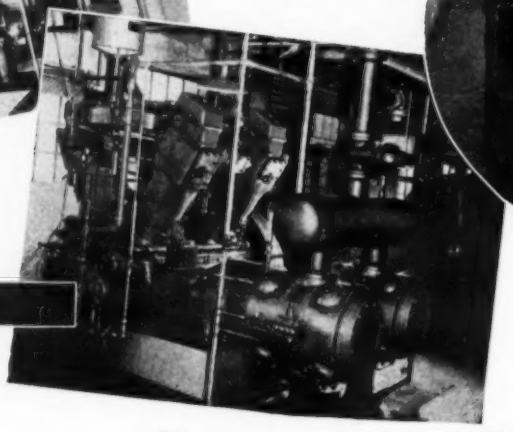
Owners everywhere tell us that it fills a long-felt need for a truly economical form of compressor to be operated in conjunction with other Diesel-powered equipment. Ask our nearest representative for further information and for Catalog 3072.

The XVO is available in sizes from 65 to 280 horse-power. Compressor cylinders can be arranged for any discharge pressure.

STONE QUARRY



ROAD BUILDING



FACTORY

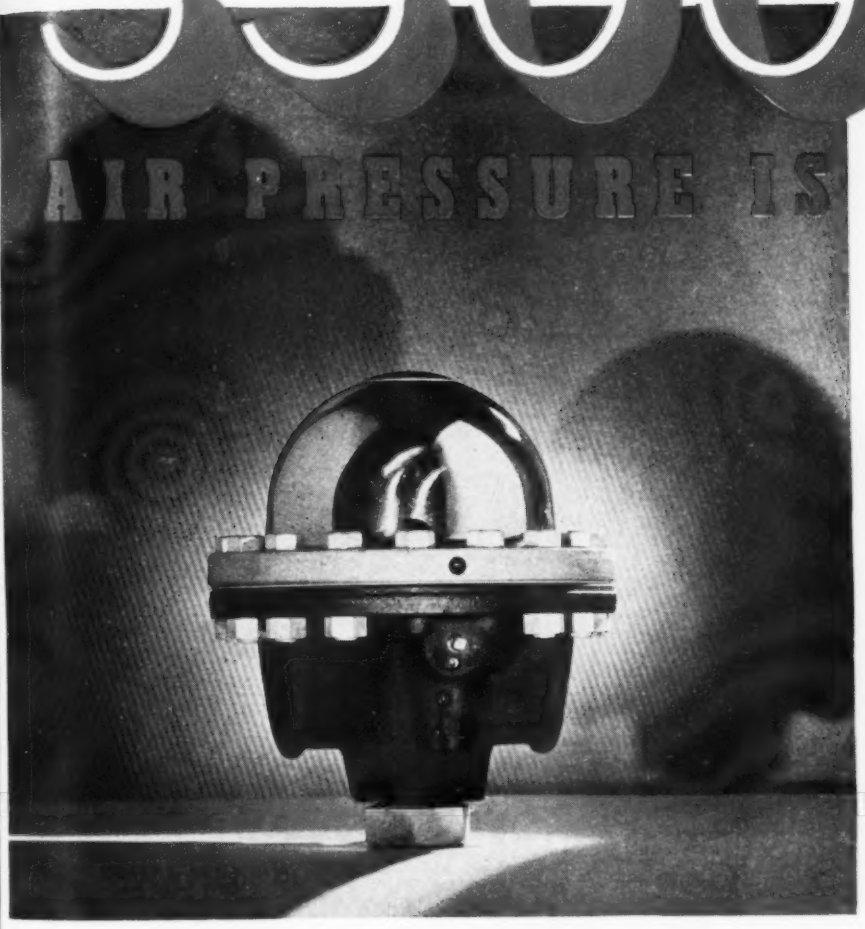
MINE

Ingersoll-Rand

11 BROADWAY, NEW YORK CITY

COMPRESSORS • BLOWERS • OIL AND GAS ENGINES • ROCK DRILLS • AIR TOOLS • CONDENSERS • PUM

REDUCING 3500#



STANDARD WITH GROVE REGULATORS

Designed to reduce initial pressures to a desired delivered pressure Grove Powreactor Dome Regulators automatically maintain the reduced pressure within infinitely close limits, regardless of changes in initial pressure or variations in flow volume. They are particularly suited for reducing 3500 lbs. pressure requirements such as on:

- ★ Gas Ejection Systems
- ★ Smoke Screen Generators
- ★ Diesel Engine Starting
- ★ Deep Sea Operations
- ★ Pneumatic Control of Deck Landing Gear

and various other services.

Write today for full details stating your particular problem and requirements.

OTHER GROVE PRODUCTS INCLUDE

- ★ *Gas Steam Fluid Pressure Reducing Valves.*
- ★ *Remote Control Shut-off Valves.*
- ★ *Automatic Reducing and Stop Valves.*
- ★ *Pneumatic Gauge Testers.*
- ★ *Small Volume, High Pressure Reducing, Back Pressure, and Relief Valve Regulators.*
- ★ *Complete Pressure Control Systems and Equipment.*

GROVE

GROVE SIMPLICITY ACCURACY SAFETY

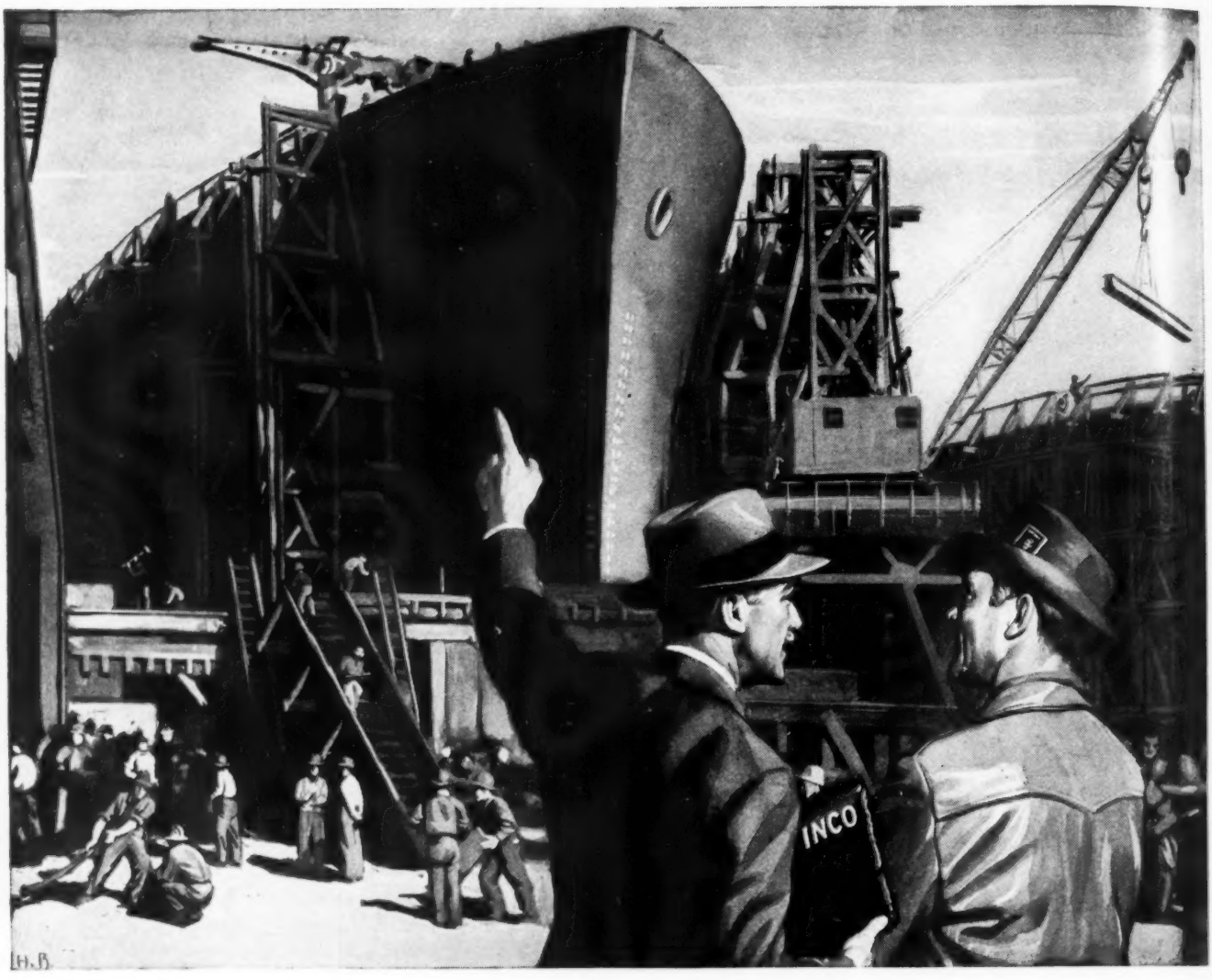
Powreactor Dome REGULATORS

PRESSURE CONTROL SYSTEMS & EQUIPMENT

GROVE REGULATOR COMPANY

1197 67TH STREET, OAKLAND, CALIFORNIA

BRANCH OFFICES: 5644 NAVIGATION BLVD., HOUSTON, TEXAS • 30 ROCKEFELLER PLAZA • NEW YORK CITY, N.Y.



NICKEL AIDS THE MARINE INDUSTRY

to KEEP 'EM SAILING!

"Uncle *Needs* His Ships." That sign in a shipyard, a thousand miles from the sea, typifies the fighting spirit of America's ship builders. These men will turn out new tonnage faster than Axis bombs and torpedoes can sink it.

In peacetime, their engineering-thinking created efficient power plants that pushed ships of commerce through the seven seas. They designed propelling machinery—turbines, valves, pumps and gears—to move the ship and intricate instruments to guide and guard it on its important mission.

From turbine rotors to propeller shafts, from reduction gears to condenser tubes, those engineers relied upon ferrous and non-ferrous alloys strengthened and toughened by additions of Nickel. They used the properties of Nickel to fight corrosion and fatigue.

During wartime, when uninterrupted operation of America's bridge of ships means so much, the continued and widespread use of Nickel is convincing evidence of its many advantages. Now that sea-going metals must withstand repeated demands for stepped-up performance, a little Nickel goes a long way to insure utmost dependability.

Marine engineers and designers have long known and builders and fitters... as well as repair crews at bases 'round the globe... are learning that, properly used, a little Nickel goes a long way to "keep 'em sailing."

For years the technical staffs of International Nickel have been privileged to cooperate with the men who build and operate ships of all types. Counsel, and printed data about the selection, fabrication and heat treatment of Nickel alloyed materials, is available upon request.

★ **Nickel** ★

Send for lists of available publications. Address your inquiries to Technical Library Service

THE INTERNATIONAL NICKEL COMPANY, INC., *67 Wall St., New York, N.Y.*

ALOYCO VALVES

—product of rigid control of six manufacturing steps...

✓1 DESIGNING
✓2 PATTERN MAKING
✓3 MATERIALS SELECTION
✓4 MACHINING
✓5 ASSEMBLING
✓6 TESTING

THE *know how* of manufacturing Stainless Steel Valves is based on experienced supervision of every step from the drafting room to the test bench. As pioneers in the manufacture of Stainless Steel Valves we have developed methods of design and manufacture which insure the highest quality.

This company makes *only* Stainless Steel Valves and Fittings. Concentration on this one type of product, backed by our highly specialized manufacturing skill and greatly increased facilities has enabled us to meet the *enormous demands* for ALOYCO Valves from TNT, Smokeless Powder, Synthetic Rubber and Aviation Gasoline plants *and with deliveries on time*.

We can supply ALOYCO Stainless Steel Valves in all sizes and types and in a wide range of alloys, on high priorities, for applications which would render the use of ordinary valves dangerous or impractical.

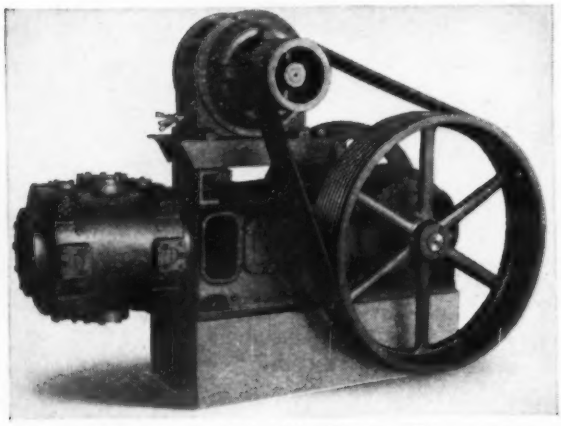
ALOYCO

Stainless Steel
VALVES and FITTINGS

GATE VALVES • GLOBE VALVES
Y VALVES • CHECK VALVES
LEVER THROTTLE GATE VALVES
TANK VALVES • SCREWED FITTINGS
FLANGED FITTINGS
GAUGE GLASS FITTINGS

Alloy Steel Products Company, Inc., 1300 West Elizabeth Avenue, Linden, N. J.

Valve Maintenance is vital to Compressor efficiency



Class T Horizontal Double-Acting Compressor with overhead motor mounting

INSPECT AND CLEAN VALVES REGULARLY

STRAIGHT valve lift without bending, rubbing or distorting . . . low discharge temperatures and low impact force resulting from low air velocities . . . lightweight valve discs of heat treated and ground stainless steel . . . stainless steel valve springs—all give CP Simplate Valves outstanding durability. They should, however, be inspected and cleaned at regular intervals, depending upon operating conditions. The precautions illustrated will help keep a compressor at peak efficiency and reduce maintenance.

HOW TO GET MAXIMUM SERVICE FROM YOUR CP COMPRESSORS

At regular intervals, remove CP Simplate Valves for inspection and cleaning. Examine them carefully for wear. Carbon formation, resulting in leakage and excessive temperature indicates the use of either too much oil, or the wrong kind of oil.

When reinstalling a CP Simplate Valve, after inspection and cleaning, always make sure assembly is squarely on seat before putting on cover.

★★★★★★★★
PNEUMATIC TOOLS
ELECTRIC TOOLS
(Hicycle...Universal)
ROCK DRILLS

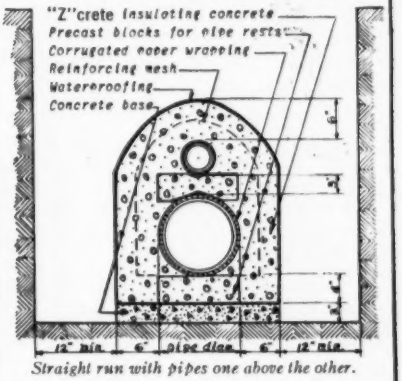
CHICAGO PNEUMATIC
TOOL CP COMPANY
General Offices: 8 East 44th Street, New York, N. Y.

★★★★★★★★
AIR COMPRESSORS
VACUUM PUMPS
DIESEL ENGINES
AVIATION ACCESSORIES

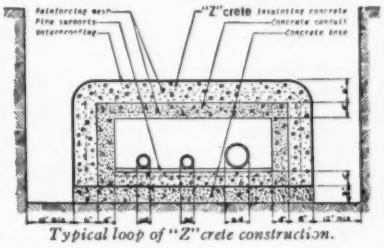
New Way To Insulate Underground Steam Lines

Gives You 6 Outstanding Advantages

Typical straight run with pipes side by side.



Straight run with pipes one above the other.



Typical loop of "Z"crete construction.

"Z"crete System is Fast, Easy, Practical

Provides High Insulation Efficiency, Permanency and Waterproofing

The problem of insulating underground steam pipes is complicated by the fact that keeping water out is very nearly as important as keeping heat in. A high degree of inherent strength is also most desirable to resist settling and to prevent excessive damage during the backfilling operation.

The new "Z"crete System fulfills all of these requirements and a number of others.

Second in importance only to its exceptional insulating efficiency is "Z"crete's continuous monolithic protection against mechanical damage. This also makes for greater efficiency in insulating and waterproofing by eliminating joints. Joints are always weak spots in any underground system, permitting heat to leak out and water to seep in. Monolithic construction also permits unbroken waterproofing to be applied externally, and further protection against absorption is provided by the inherently non-hygroscopic nature of the material itself.

"Z"crete owes its extremely high insulating efficiency to "Z"crete Aggregate, a featherweight, all mineral granular material made by exploding an unusual type of mica. It is chemically inert, fireproof and rotproof, making it especially suitable for underground installations. New "Z"crete literature explains "Z"crete's advantages and also gives complete construction details. It is yours merely for mailing the coupon at right. Why not mail it at once and have this data in your files?

For specifications and engineering data write to:

UNIVERSAL ZONOLITE INSULATION COMPANY
Dept. P5, 135 South La Salle Street, Chicago, Illinois

MAIL COUPON FOR DETAILS

UNIVERSAL ZONOLITE INSULATION COMPANY
Dept. P5, 135 S. La Salle St., Chicago, Ill.

Please send me full information about the "Z"crete systems for underground pipe insulation.

Name.....

Address.....

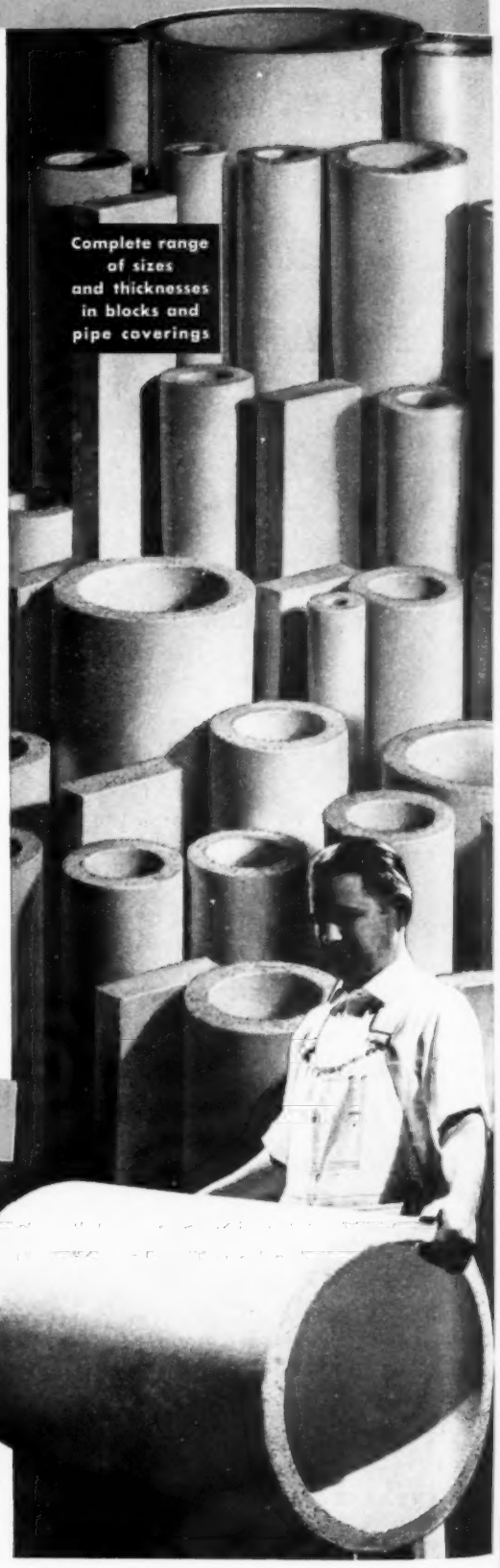
City.....*State*.....

THE HEAT INSULATING MATERIAL OF THE FUTURE IS HERE *TODAY!*

REALIZES
9 LONG-WANTED FACTORS
IN HEAT INSULATION

by capitalizing upon the time-tested insulation values of 85% Magnesia!

- ***Unprecedented light weight!*** Weighs just 11 pounds per cubic foot!
- ***Lower thermal conductivity!*** Over full range of temperatures, average "Kf" is .354...compared to "Kf" of .457 for heat insulating material of 16.8 pounds per cubic foot density!
- ***Controlled uniformity*** to a degree heretofore unachieved! Plant's plus tolerance is only ½ pound per cubic foot.
- ***Super-smooth finish*** on both inner and outer surfaces.
- ***Greater "ductile strength"*** built right into the material! Withstands vibration, shipping, accident shock and dropping much better than present-type materials!
- ***Cleaner!*** Less "clean-up" after job completion! Better working conditions for applicator because it doesn't "powder" or "dust up"!
- ***More durable!*** The proverbial long-service life of 85% Magnesia plus new toughness! Can be removed and re-used if desired. If wet, it will not "mush"—retains normal structure after drying!
- ***Simpler and speedier to apply!*** Easier to lift, cut and score. Simpler to embed tie wires flush in surface, too!
- ***Precision pipe fit!*** Both pipe coverings and blocks of Plant Precision Molded 85% Magnesia are molded to exact final size and thickness . . . not molded oversize and then "milled" to size.



War has hastened by many years the introduction of this new, revolutionary, patented* ***Plant Precision Molded*** process of manufacturing 85% ***Magnesia*** heat insulating material. A chemically true 85% Magnesia, meeting the requirements of all Federal specifications, ***Plant Precision Molded*** incorporates advancements that deserve careful study wherever heat insulation is necessary. Complete descriptive material sent upon your request.

PLANT
RUBBER & ASBESTOS WORKS
Manufacturers of Plant Insulating Materials and Mechanical Packings Since 1920
MAIN OFFICE: SAN FRANCISCO
Sales Offices in Los Angeles, Wilmington, and Oakland; distributors in principal cities.
Factories in Emeryville, San Francisco, and Redwood City, Calif.

PLANT PRECISION MOLDED
REG. U. S. PAT. OFF.
85% MAGNESIA
"THE DEPENDABLE STANDARD—MODERNIZED"

*U. S. Patents Nos. 2,131,374, 2,209,752, 2,209,753, 2,209,754.

● **Eliminate Air**—Cut tube end erosion by installing air and erosion eliminators. These removable screen plates, fitted with air ejection piping, remove air from circulating water before it attacks tube sheets and tube ends. Increase tube life from three to seven times in the average installation.

● **Detect Weak Tubes by Shock Test**—The 10-year-old hydro-dynamic Shock Test destroys tubes just ready to fail. Frequently, less than ten percent of the tubes in large condensers require replacement, but, unless discovered and removed, they will soon necessitate another shut-down and even major overhaul. Only by Shock Test can you mechanically and accurately distinguish good tubes from bad.

● **Stop Tube End Wear**—Use FLOWRITES, replaceable, bell-mouthed sleeves at entrance ends of either new or old tubes. They provide smooth, directed flow of circulating water, eliminating air pockets and preventing air caused erosion of tube ends and pinholes.

● **Stop Tube Leaks—Fast**—The WIZARD Injector and Special Sealing Compound will stop tube leaks in a few seconds.

✔ **Don't Scrap Tubes with Worn Ends**—Even tubes with ends worn through can be salvaged. If they withstand the Shock Test, we can stretch them to usable lengths, cut off the bad ends and return them to service.

★ ★ ★

In holding down condenser maintenance costs, the Big League Utilities have kept our facilities and our field crews busy for seventeen years. Today, uninterrupted flow of power for war production is more essential than ever.

Avoid breakdowns and priority holdups by taking advantage of Conseco nation-wide, clock-around service. A letter, telegram or 'phone call will start your job rolling. Estimates furnished for specific work.

Condenser Service
AND ENGINEERING CO., INC.

81 RIVER STREET, HOBOKEN, NEW JERSEY

★

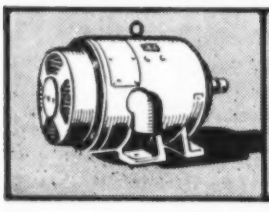
NEW JERSEY TELEPHONE—HOBOKEN 3-4425

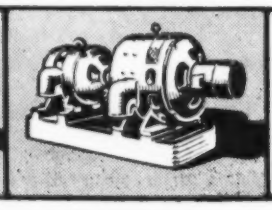
NEW YORK TELEPHONE—RECTOR 2-9360 **AFTER 6 P. M. AND SUNDAYS—HOBOKEN 3-4428**

1/20th TO 1000 K.W. GENERATORS

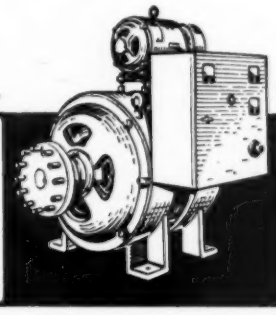
SOMEWHERE on U. S. fighting fronts, thousands of the Burke hand generator units shown above are making 1/20 of a kilowatt a very important unit of power. Somewhere in between this junior generator and the Burke 1000 K.W., D.C. or A.C. generator lies the answer to your generator problem. Perhaps you have an old reliable that should be retired, but because of the 24-hour schedule that your plant is operating under, you just cannot take the time it takes to replace it. Perhaps you are expanding and you need more generating capacity. In either case, we want you first to know Burke better, and then we want to know your problem in detail. Write for our general bulletin today.

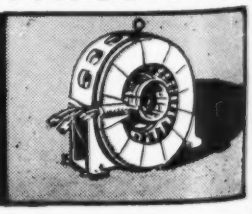
BURKE ELECTRIC COMPANY • ERIE, PA. **SINCE 1891**



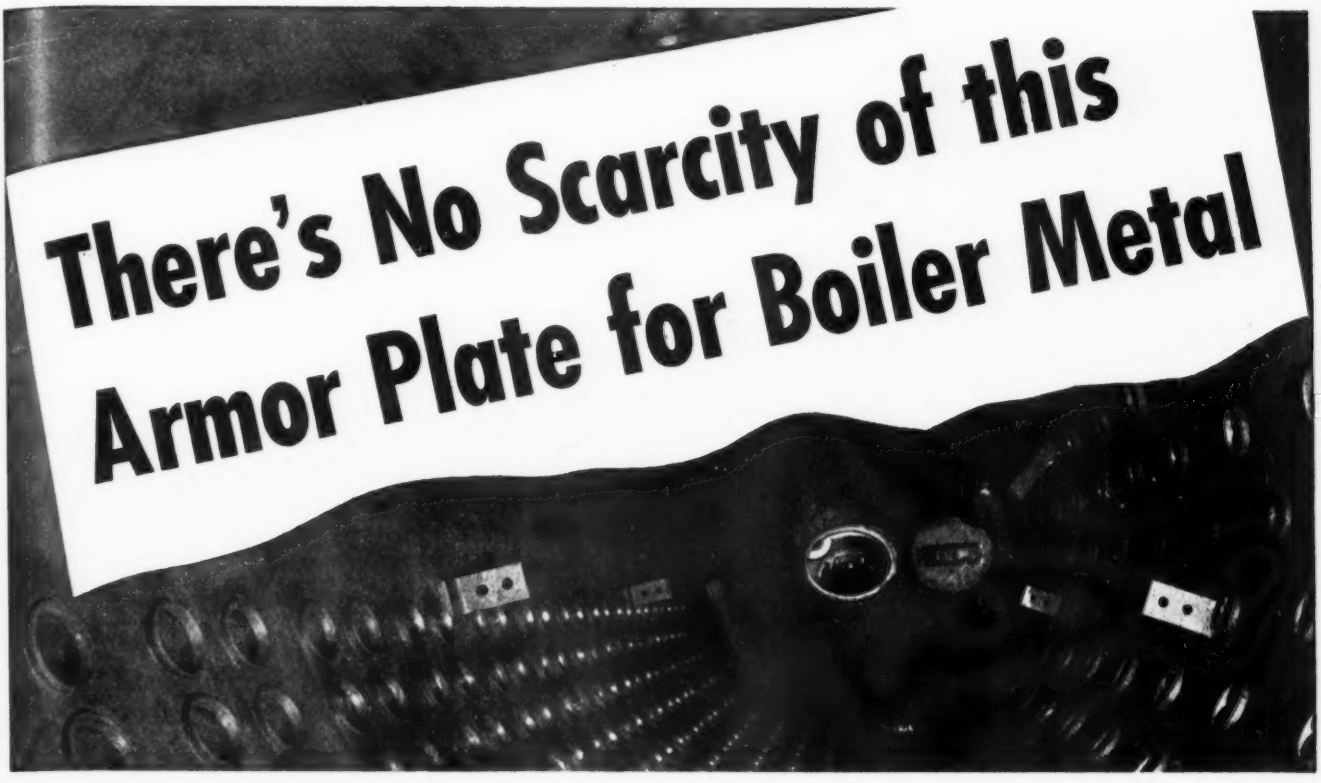


D.C. Equipment to 1500 H.P. and 1000 K.W.
A.C. Equipment to 1500 H.P. and 1000 K.W.
M-G Sets to 1000 K.W.
Molded Bakelite Terminal Blocks





There's No Scarcity of this Armor Plate for Boiler Metal



The metal in your boilers is worth its weight in gold, and when worn out, is practically irreplaceable. Yet power demands are increasing every day.

Here's the story of an essential maintenance, repair and operating material that will keep your boilers in service for years to come. It's available. It's economical. It's recommended by boiler insurance companies and endorsed by thousands of industrial power plants, utilities, railroads and marine operators. Even boilers about to be condemned have sometimes been cleaned, found in better condition than suspected, and given extra years of life with APEXIOR protection.

APEXIOR "Plates" Boiler Metal* for Resistance against Wear, Corrosion

Any boiler that can get an O.K. from inspection and a hydrostatic test is O.K. for plenty of war work, because the test strength can be maintained by applying, after cleaning, a durable coating of APEXIOR.

APEXIOR is brush-applied, by hand or power-coater. It forms a tough, impervious barrier against the water, and prevents corrosion for as long as 2 to 3 years (often longer), then can be easily renewed. Scale cannot form a tight bond with the APEXIOR surface — and is quickly removed with a wire brush.

Many more operators than ever before are using APEXIOR, but we have enlarged our facilities in order to help you overcome the problems of metal scarcity. APEXIORIZE — it's the quick, low-cost way of insuring your boiler life.

*Turbine metal, too. Some manufacturers coat shafts and rotor bodies and frequently the interior of casings of all turbines with APEXIOR before shipment to customers.

FREE BULLETINS 1290 (General), 1305 (Marine), Offer Aid to War Service Boilers.

Users like these have applied APEXIOR for years. APEXIOR will help YOU get more service from irreplaceable equipment.

Illinois Central Railroad Co.
Detroit Edison Co.
Hercules Powder Co.
Aluminum Company of America
Union Electric Company of Illinois
Goodyear Tire & Rubber Co.
Utah Copper Co.
General Motors Corp.
U. S. Maritime Commission
Allis-Chalmers Mfg. Co.
Connecticut Light & Power Co.
Cunard White Star, Ltd.

•

ENGINEERING SALES REPRESENTATIVES

Pittsburgh, Cincinnati, New Orleans, San Francisco, Los Angeles, Portland, Seattle, Phoenix, Denver, Salt Lake City, Dallas, Houston, Vancouver, B. C., Montreal, P. Q., Havana, Cuba, Manilla, P. I., Honolulu, T. H., Marine Dept., 114 Liberty Street, New York, N. Y.

APEXIOR

A Peacetime Plus ★ ★ ★ A Wartime Must

RECOMMENDED BY ALL U. S. AND CANADIAN BOILER INSURANCE COMPANIES

The **DAMPNEY COMPANY** of America
protective coatings for
STATIONARY BOILERS, LOCOMOTIVES AND STEAMSHIPS

THE DAMPNEY COMPANY OF AMERICA
Hyde Park, Mass.

Please send free Bulletin 1290 (General) ☐ 1305 (Marine) ☐ to:

Name.....

Company.....

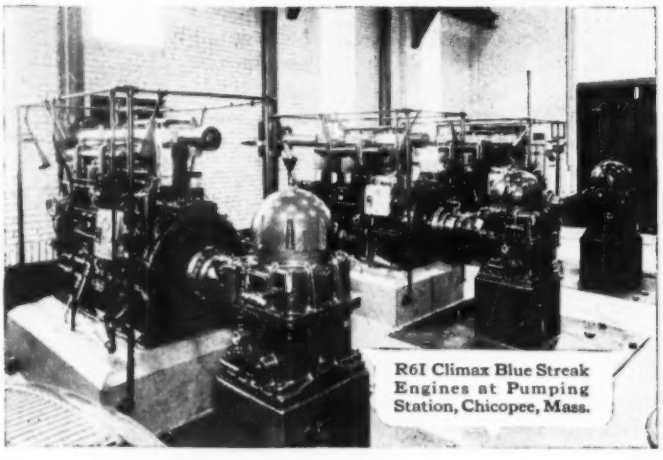
Address.....

Main Office: **HYDE PARK • BOSTON • MASS.** • Branch Offices: **ATLANTA • CHICAGO • NEW YORK • DETROIT • PHILADELPHIA**

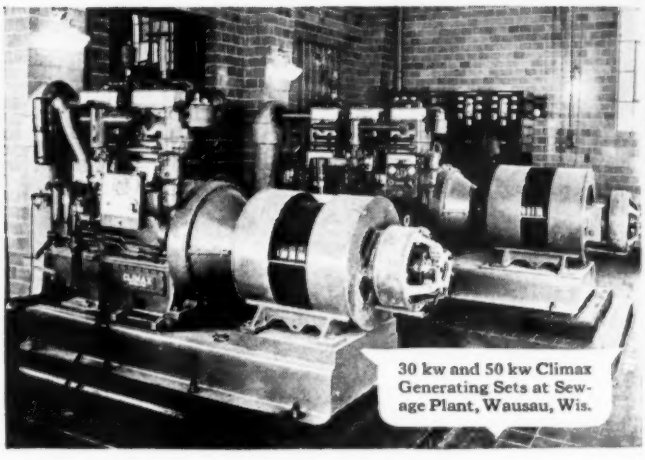
Shall we buy or make the power?

The power engineer's responsibility is to buy or make power—whichever is cheaper—and deliver it instantly and without fail in the amount required. Frequently the choice is a job for the consulting engineer with facts to indicate the right choice among the forms available. Below are some facts in the case for internal combustion power typified by . . .

Climax ENGINES and GENERATING SETS



R6I Climax Blue Streak Engines at Pumping Station, Chicopee, Mass.



30 kw and 50 kw Climax Generating Sets at Sewage Plant, Wausau, Wis.

Services and Operating Advantages . . .

For Normal Power—Climax Generating Sets provide wholly independent power. They end stoppage due to outside power failure, meet load variations through parallel operation, and permit economical load growth.

For Stand-by Power—These sets lengthen equipment life by preventing overloading. Complete protection is assured for valuable machinery requiring continuous operation. Higher loading is possible without comparable increase in cost.

For Utility Pumping — Quick starting qualities, high dependability and long life make Climax Engines and Generating Sets preferred for flood control, irrigation projects, mine pumping and general water utility services.

For Industrial Plants—High thermal efficiency, relatively low first cost and extreme flexibility make Climax power units ideal for shop and factory power, especially in plants with minimum steam requirements. The smallness of the unit does not impair to any extent its thermal efficiency. The ability to burn different fuels permits full advantage to be taken of those obtained locally, with efficient operation on whichever competitive fuel is cheaper.

For Sewage Plants—Transforming waste gas into effective energy and improving health through scientific sewage treatment are two benefits obtained from gas engines. From a monetary standpoint, Climax Gas Engines are not merely lowering the cost of sewage disposal but are enabling many municipal plants to eliminate outside power bills and have an ample, self-generated power reserve for emergency use.

This List of Profitable Climax Applications can be multiplied many times. Every day the gas engine is proving its value to new fields. Frequently it brings a new standard of performance with lower investment costs, lower operating costs and long-time gains.

Write Today to Climax Engineering Co., Dept. X, for fuller details on the case for the internal combustion engine. Give load characteristics, nature of fuels available and other particulars. With adequate information, Climax can design a power plant 'tailored' and equipped to do the job dependably and economically.

ARMY NAVY "For High Achievement in the Production of War Materials"

Climax Engineering Company

GENERAL OFFICES & FACTORY

CLINTON, IOWA

REGIONAL OFFICES: CHICAGO, ILL., DALLAS, TEXAS

IS IT POSSIBLE FOR THE INVISIBLE to DISAPPEAR?

LUBRICATING oil—from exposure to heat and pressures existing in engines—forms harmful, soluble, invisible impurities; acids, resins and gums.

Yes, these invisibles can be made to disappear, and must be removed, too, or real engine operating trouble will result.

Briggs Oil Clarifiers remove all trace of invisible impurities and protect your engine against oil sludging by properly and completely clarifying every drop of oil.

Patented blocks of Fullers Earth and cellulose comprise the replaceable Clarifier Cartridges which ADsorb all engine-corroding acids and sludge-forming gums and resins . . . and ABsorb all carbon, dirt and grit . . . thus maintaining oil chemically clean as well as physically pure.

Briggs research laboratories developed the Fullers Earth Block type refill and have designed the Clarifiers adaptable to any type installation.

Daily, Briggs engineers solve the many oil problems of wartime industries, the Army, Coast Guard, Navy, and Maritime Commission. Write for detailed information and our recommendations on the model Clarifier you need.

BRIGGS Clarifier CO.

1339 WISCONSIN AVE. WASHINGTON, D. C.

Model D-6-BR Briggs Clarifier, containing 6 Fullers Earth Block refills—only one of many models used today on thousands of war machines. Briggs Clarifiers range in size and shape, adaptable to any make engine.

YOUR HOME FRONT JOB: BUY WAR BONDS AND STAMPS

Sure, All Valves Look Alike

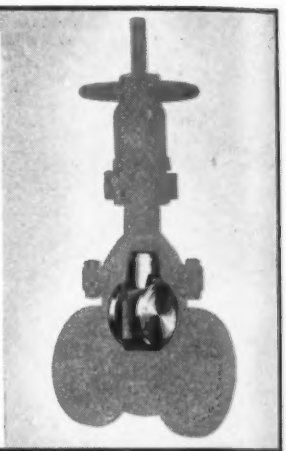
But..It's What's Inside That Counts!

Any engineer will tell you there isn't much difference in the outside appearance of most gate valves. Why should there be? It's the *inside* story that really counts. And it's that same inside story—the assembly—the simplicity of design—the rugged construction—the leak-proof machined surfaces—that has made the Darling Parallel Seat, Double Disc Gate Valve a leader in the field for more than forty years.

No. 1

THE ASSEMBLY-ONLY 4 PARTS

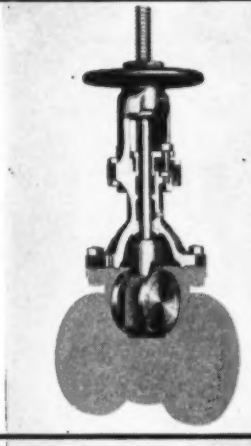
Two discs and two wedges—the entire working part assembly of a Darling Double Disc Gate Valve. There is no other valve with this design. The seats are parallel. The discs are *fully revolving*, seating in a different position each time the valve is operated.



No. 2

QUICK AND EASY TO REPACK

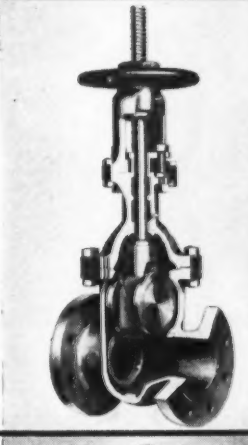
It's inside refinement like this that counts in a gate valve. The Darling Stem Collar is machined to tightly seat against the bonnet bushing. This permits *repacking* of the valve *in* service. The Valve Bonnet has two separate chambers, the lower being a condensation chamber protecting the packing above. This permits sampling or pressure relief while repacking stuffing box.



No. 3

DENSE CASTINGS THAT ASSURE GREATER STRENGTH

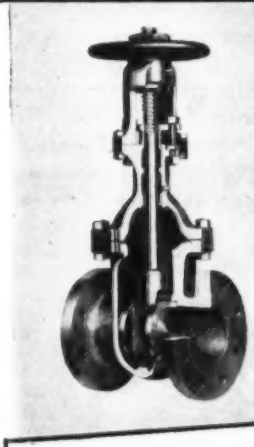
There are no "lot" testings. The body of each and every Darling Valve, like all other parts, is tested individually to its rated pressure. There are no sharp corners. Generous radii throughout eliminate casting strain and insure maximum strength. Darling Valve bodies are designed for quick, easy and inexpensive parts replacement.



No. 4

NO LEAKAGE AT ANY PRESSURE

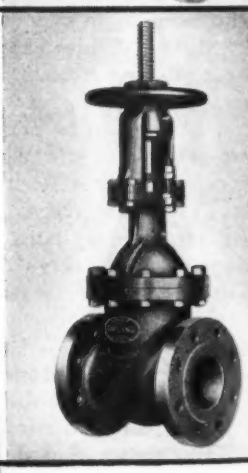
When the discs roll into place and the parts are sealed, there is no leakage. There can't be. All seating surfaces, by special Darling processes, are super-machined to a glass-like surface that assures a complete seal for any fluid or gas passing through the line.



No. 5

THERE'S A DARLING VALVE FOR YOUR TOUGHEST JOB

No matter what that tough job involves, corrosive or erosive materials, high or low pressures or temperatures, special alloys, unusual installations, severe operating conditions, where those problems occur, that's the place Darling Gate Valve design can positively prove its value. Write for the new Darling Catalog and Data Book.



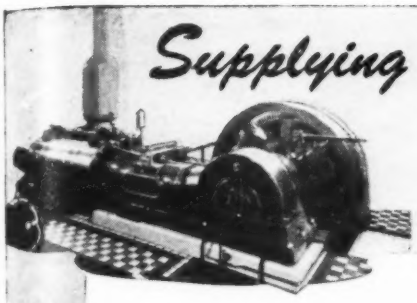
Darling manufactures a quality line of longer-lasting Gate Valves. They come in Fully Revolving Parallel Seat Double Disc, also in Taper Seat—Slotted and Solid Wedge types. In service pressures up to 3000 pounds, available in Cast Iron, Bronze, Forged Steel, Cast Steel, and Corrosion Resistant Alloys. Darling also manufactures Compression Type Fire Hydrants, Check Valves, Motor and Cylinder Operated Valves, and many accessories.

DV-43-102

TRADE DARLING MARK

VALVE & MANUFACTURING CO.

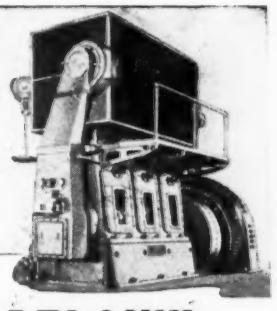
WILLIAMSPORT, PA.



Supplying Dependable, Economical

ELECTRIC POWER

for Industry



SKINNER "UNIVERSAL UNAFLOW" STEAM ENGINES

FOR three-quarters of a century the Skinner Engine Company has been building steam engines exclusively. The performance of Skinner Engines has been so outstanding that they have achieved the reputation of being "the most economical steam engines ever built."

Skinner "Universal Unaflow" Steam Engines, horizontal or multi-cylinder vertical, drive generators that furnish electricity for light and power to many of the nation's best known hotels, hospitals, department stores, office buildings and diversified industrial and institutional plants. By generating their own electric current instead of buying it from the local utility companies, these owners have saved millions of dollars in power costs. Other Skinner Engines drive compressors, pumps and blowers for refrigeration and air conditioning installations.

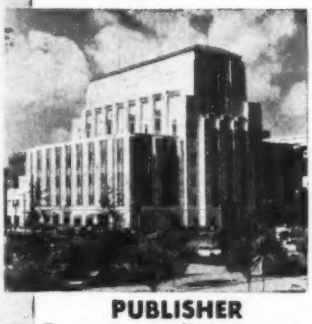
Tomorrow profits will come from economy. As in the past, many efficient power users will find that in no other department of their business can savings be effected equal to those made by using Skinner "Universal Unaflow" Steam Engines to generate power, utilizing the exhaust steam for heating and processing purposes.

Dependability and permanently maintained economy are inherent characteristics of Skinner Poppet-Valve Unaflow Steam Engines, and are largely responsible for the fact that more than 25% of all orders received are repeat orders. This is not only a high tribute, but also is testimony of complete satisfaction.

Although you may have a seemingly low *rate per kilowatt-hour* for purchased power, it will pay you to investigate, for postwar planning, how much lower your *cost* will be for power generated by Skinner Engines.

Our production facilities, at present, are devoted entirely to building Skinner Unaflow Steam Engines for the war program.

SKINNER ENGINE COMPANY FOUNDED IN 1868 **ERIE, PA.**



PUBLISHER

Famous metropolitan newspaper in Los Angeles, Cal. Three horizontal "UNIVERSAL UNAFLOW" Steam Engines, driving 572-kv.a., 3-ph., 60-cy., 240-v., A-C generators, with V-belted exciters. Steam pressure 190 psi., 150° F. s.h., back pressure 5 psi. Exhaust steam used for building heat and air conditioning. Installed in 1934.

OFFICE BLDG.

Prominent building in Philadelphia, Pa. Three horizontal "UNIVERSAL UNAFLOW" Steam Engines, driving 250-kw., 250-v. D-C generators. Steam pressure 190 psi., 50° F. s.h., back pressure 2 psi. Installed in 1922.

DEPT. STORE

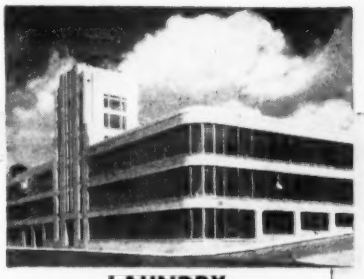
Large store in Cincinnati, Ohio. One vertical, three horizontal "UNIVERSAL UNAFLOW" Steam Engines, with 250-v. D-C generators. One 300-kw. (1916); two 250-kw. (1927); one 800-kw. (1937). Steam pressure 140 psi., 25° F. s.h., back pressure 2 psi. Exhaust steam used for building heat and air conditioning.

Our Seventy-fifth Anniversary

1868 – 1943

BAKERY

Nationally-known bakery in Buffalo, N. Y. Five horizontal "UNIVERSAL UNAFLOW" Steam Engines: one 167-hp., driving ice machine; four with 3-ph., 60-cy., 225-v. A-C generators, separate M-G exciter sets. Three are 250-kv.a., one 312-kv.a. Steam pressure 150 psi., 100° F. s.h., back pressure 2 psi. Installed in 1922, '24, '28. This company has purchased 25 "UNIVERSAL UNAFLOW" Engines.

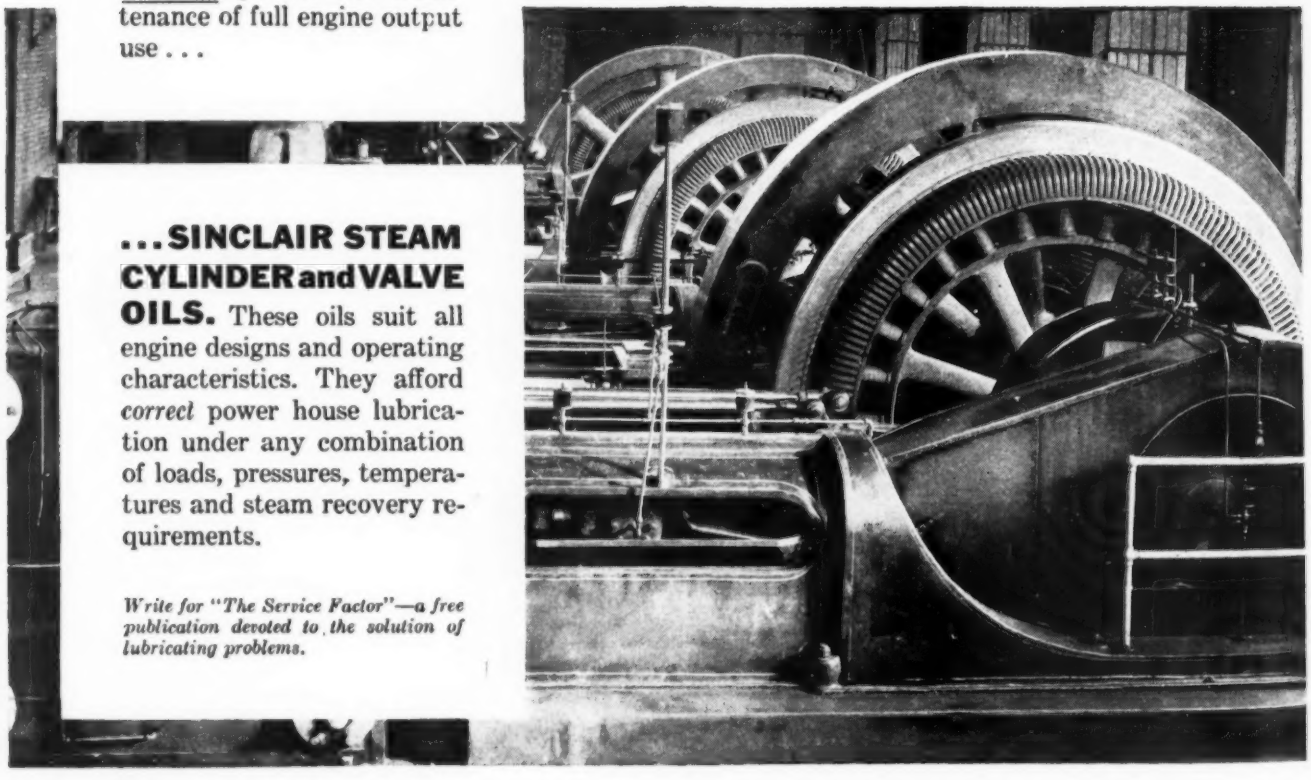


LAUNDRY

Modern laundry in New York City. Two "UNIVERSAL UNAFLOW" Steam Engines, with 219-kv.a., 3-ph., 60-cy., 208/120-v., 4-wire A-C generators, belted exciters. Steam pressure 150 psi., sat., back pressure 5 psi. Installed in 1931.

Proudly we fly the Army–Navy "E" Flag, awarded for excellence in production

.....FIGHTING STRENGTH needs *STEAM* power. For maintenance of full engine output use . . .



...SINCLAIR STEAM CYLINDER and VALVE OILS. These oils suit all engine designs and operating characteristics. They afford *correct* power house lubrication under any combination of loads, pressures, temperatures and steam recovery requirements.

Write for "The Service Factor"—a free publication devoted to the solution of lubricating problems.

SINCLAIR INDUSTRIAL OILS

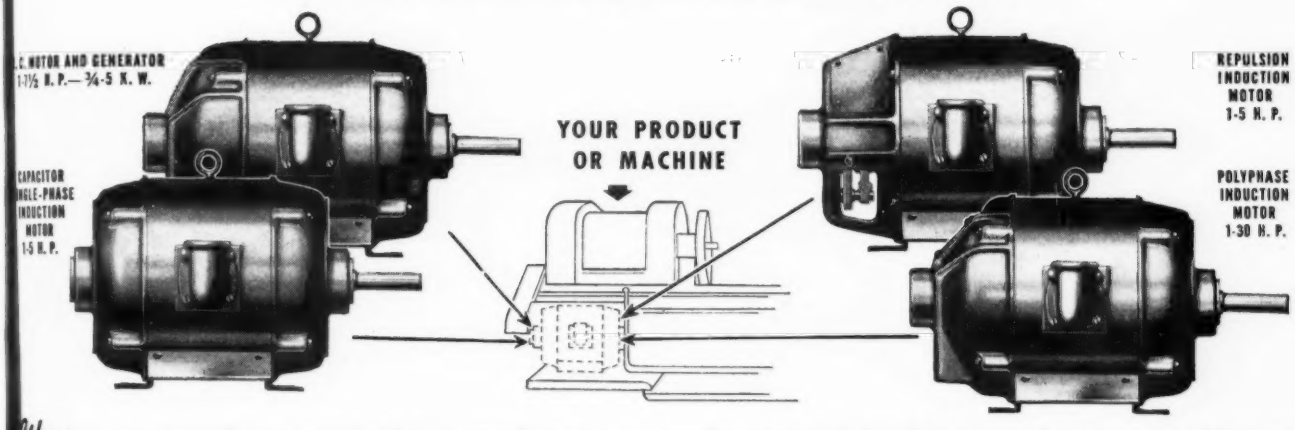
FOR FULL INFORMATION OR LUBRICATION COUNSEL WRITE NEAREST SINCLAIR OFFICE

SINCLAIR REFINING COMPANY (Inc.)

2540 West Cermak Road • Chicago | 10 West 51st Street • New York City | Rialto Bldg. • Kansas City | 573 West Peachtree Street • Atlanta | Fair Building • Ft. Worth

Look! You can INTERCHANGE *R&M Uni-Shell* MOTORS INSTANTLY!

They're the only complete motor line in which* all types *in any one frame size are* interchangeable *and similar in appearance!

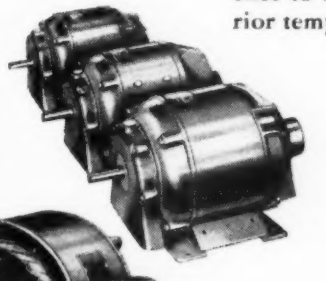

D.C. MOTOR AND GENERATOR
1-7½ H.P.—¾-5 K.W.
CAPACITOR SINGLE-PHASE INDUCTION MOTOR 1-5 H.P.
YOUR PRODUCT OR MACHINE
REPULSION INDUCTION MOTOR 1-5 H.P.
POLYPHASE INDUCTION MOTOR 1-30 H.P.

Whether you manufacture motor-driven products or just use motors on the production machines in your shop, you can readily see the tremendous advantage that R & M Uni-Shell Motors offer you in *complete interchangeability.* No longer need you redesign or rebuild machines to take different types of motors, for where one type of Uni-Shell Motor can be mounted, so can *any* in the same frame size! Shell dimensions, shaft-head fit, bolt circle holes, base, shaft size and conduit box mountings are identical for all.

In the 30-month development and testing period R & M engineers worked out many *other* improvements, too, that make Uni-Shell Motors the most efficient, dependable and durable in R & M's 50 years of motor building. For complete protection, they're built in shells of steel. Better bearings and better balancing assure unusually smooth, trouble-free operation. New insulating techniques, together with the finest materials obtainable, increase motor life. And we have utilized our broad fan-building experience to make ventilation better than ever, keeping interior temperatures *below* guaranteed maximums

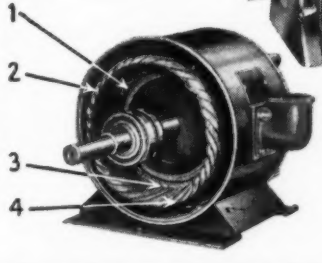
RIP-PROOF, SPLASH-PROOF MOTORS

ve covers added, or special heads. Left to right: olyphase, direct current, and repulsion induction otors with covers.



ETTER INSULATION FOR LONGER LIFE

Two layers of highest-grade impregted rag paper. 2. Wire coated with uble-weight synthetic resin for strength d flexibility. 3. Added sheet of imegnated paper placed between coils lot. Improved method used for holdg end coils. 4. Entire winding assembly ven several baked coats of synthetic in-base varnish and covered with isture-resistant synthetic resin and g-oil sealer.



20-PAGE BOOKLET TELLS THE WHOLE STORY

All of the many advantages and features of R & M Uni-Shell Motors are fully described and illustrated in a 20-page booklet just off the press. To get *yours* promptly, fill in the coupon below and mail it today.

Mail This Coupon Today!

ROBBINS & MYERS, INC., Springfield, Ohio

Gentlemen: Please send me your new 20-page booklet on Uni-Shell Motors.

Name.....*Position*.....
Company.....
Street Address.....
City.....*State*.....

I would ☐ would not ☐ like to talk to a representative. P3

ROBBINS & MYERS • INC.
MOTOR DIVISION, SPRINGFIELD, OHIO
HOISTS & CRANES • MACHINE DRIVES • FANS • MOYNO PUMPS • FOUNDED 1878

STRENGTH

is the first requisite of

HIGH-PRESSURE BOILER TUBES

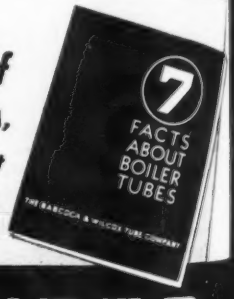
Babcock & Wilcox Seamless Steel Boiler Tubes are recognized throughout industrial America for design and materials. The best boiler can be no more efficient than the tubes which form its backbone. And the whole unit must be a combination of a designing and manufacturing skill that is based on sound engineering experience. The long and successful growth of B&W, the nation's oldest and largest manufacturer of steam boilers, attests to that skill.

TA-1246

Besides these important attributes, Babcock & Wilcox Tubes have built their reputation on

- *Adequate Stocks*
- *Technical Advice*
- *Financial Stability*
- *Quick Action in Emergencies*
- *Resourcefulness*
- *Auxiliary Services*

The B&W Technical Staff *has prepared Bulletin T-14A, which contains important facts on boiler tubes. Available upon request.*



BABCOCK & WILCOX TUBES

HOT FINISHED COLD DRAWN ALLOY STEELS CARBON STEELS

THE BABCOCK & WILCOX TUBE COMPANY, BEAVER FALLS, PA.

ONE of FOUR

Surface Condensers
Totaling 122,000 Square Feet

Typical of larger surface condensers designed and built by Lummus is this 36,000 square foot unit for a well-known public utility. Precision workmanship in the Lummus Company plant will facilitate easy and accurate assembly in the field.

All Lummus condensers are equipped with air ejectors designed and built by Lummus.

DESIGN FEATURES
LUMMUS SURFACE CONDENSERS

- Streamlined Tube Layout
- Internal Air Cooling Section
- Deaerating Hotwell

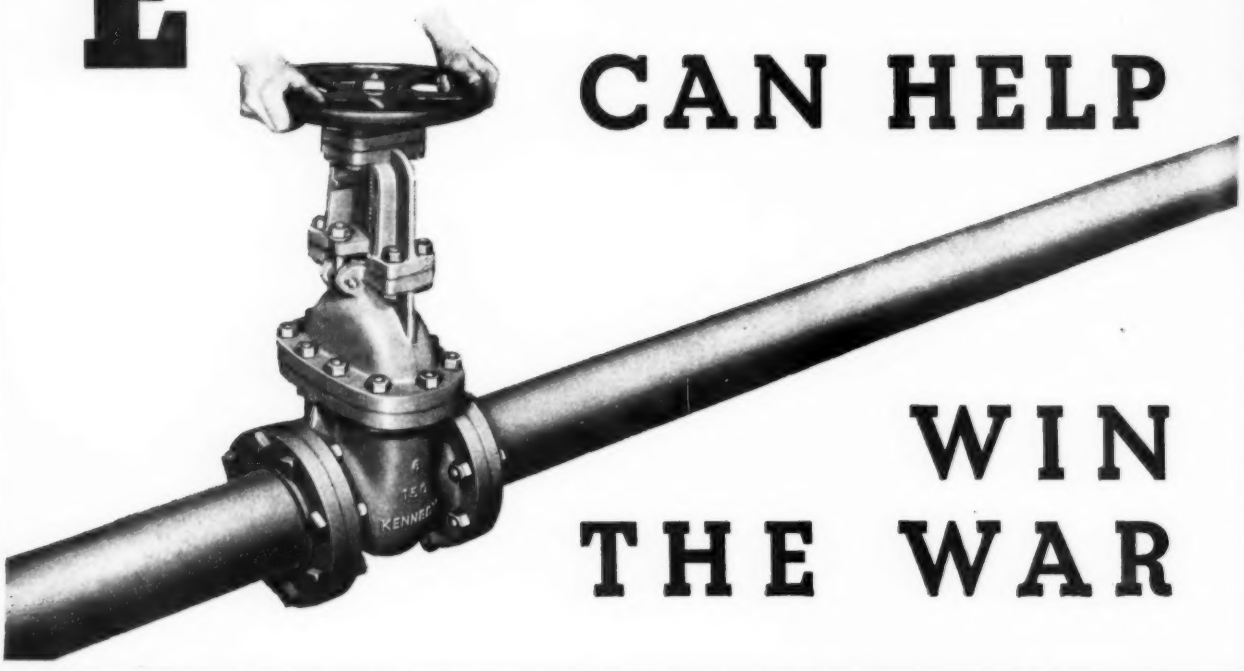
RESULTING IN —

- Minimum Pressure Drop
- Minimum Condensate Depression
- Minimum Condensate Oxygen Content
- Minimum Air Ejector Steam Requirements

THE LUMMUS COMPANY · 420 LEXINGTON AVE., NEW YORK, N.Y.

LUMMUS

EVEN VALVES CAN HELP WIN THE WAR



Have you a copy of the 240-page Kennedy Catalog? If not, write us today . . . you'll find it helpful in selecting the right valves for your needs.

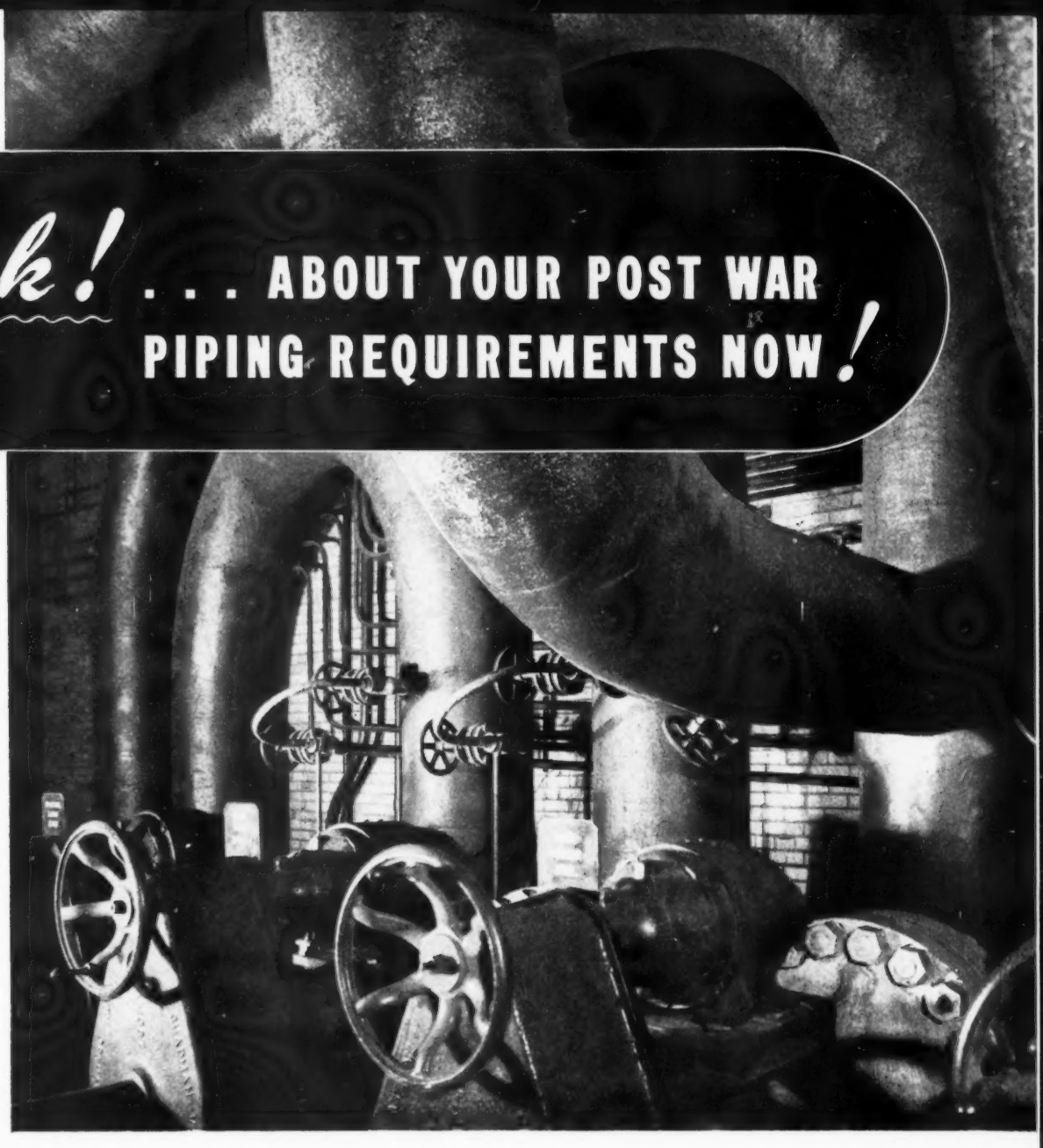
Easy operation . . . tight closure . . . dependable service . . . freedom from maintenance expense . . . convenient adjustments . . . these valve characteristics help to make a plant run smoothly and keep production up to schedule.

You are sure of all these characteristics with Kennedy Valves. Their sturdily built bodies have a generous margin of strength for rated pressure . . . their simple, accurately machined operating mechanisms respond unfailingly and securely . . . their large handwheels, deep stuffing boxes and specially designed stem threads provide convenient manipulation . . . and each type has several distinctive features for better, longer service.

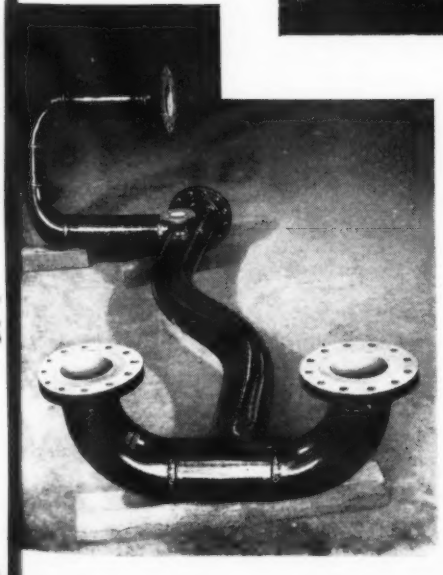
You are safe when you buy Kennedy Valves . . . iron-body and bronze in all standard types and sizes.

THE KENNEDY VALVE MFG. CO.
ELMIRA • NEW YORK

KENNEDY *valves . . . pipe fittings . . . fire hydrants*



Think! . . . ABOUT YOUR POST WAR PIPING REQUIREMENTS NOW!



THE potential demand for post-war industrial power is assuming enormous proportions. Each day that the war is prolonged increases that potential. Power plants throughout the entire nation are taxed to capacity. Partial replacements of equipment or new additions are in many cases only temporary expedients. Sooner or later, when materials are available, complete renovations or entire new systems, with modern, economical equipment are inevitable.

Pittsburgh Piping and Equipment Company's forty years of successful experience in research, engineering and development in the fabrication of *single units* or *complete piping systems* for central stations, chemical and process plants qualifies us to make recommendations concerning any changes you may contemplate. Any immediate replacements, improvements, or additions to present equipment should be planned with an eye to future specifications.

Our facilities for bending, welding, machining, heat treating, stress-relieving . . . experienced personnel for fabricating and erecting . . . a well equipped metallurgical laboratory to constantly check materials and operations during field erection as well as fabrication . . . assure accuracy, quality, dependability.

Start your post-war program today. Let our engineers help you plan improvements, additions, or complete new plants. Contact our nearest representative or write us direct. There is no obligation.

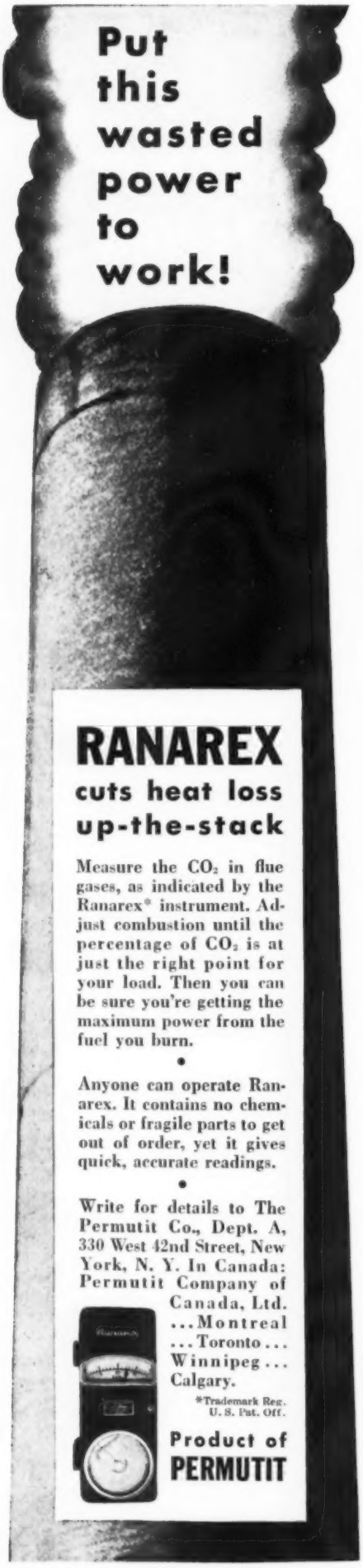
INVEST TODAY IN BONDS FOR VICTORY

Pittsburgh Piping AND EQUIPMENT COMPANY

10 FORTY-THIRD ST., PITTSBURGH, PA.

Woolworth Building, New York · · Occidental Building, Indianapolis · · Peoples Gas Building, Chicago · · Book Tower, Detroit
Public Square Building, Cleveland · · 10 High Street, Boston · · 525 Market Street, San Francisco

Put this wasted power to work!



RANAREX

cuts heat loss up-the-stack

Measure the CO_2 in flue gases, as indicated by the Ranarex* instrument. Adjust combustion until the percentage of CO_2 is at just the right point for your load. Then you can be sure you're getting the maximum power from the fuel you burn.

•

Anyone can operate Ranarex. It contains no chemicals or fragile parts to get out of order, yet it gives quick, accurate readings.

•

Write for details to The Permutit Co., Dept. A, 330 West 42nd Street, New York, N. Y. In Canada: Permutit Company of Canada, Ltd. ... Montreal ... Toronto ... Winnipeg ... Calgary.

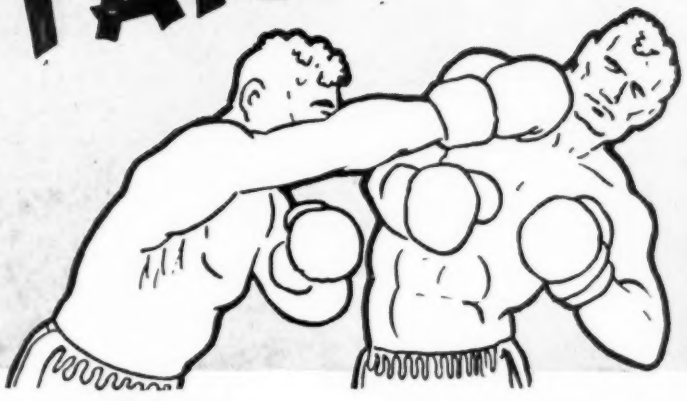
*Trademark Reg. U. S. Pat. Off.

Product of **PERMUTIT**

ECLIPSE

SEAMLESS FLEXIBLE METAL HOSE .....CAN

DISH IT OUT AND TAKE IT!



★IN DIESEL EXHAUST APPLICATIONS

Eclipse Seamless Hose resists the heat and the punishment that play havoc with other types of exhaust outlets.

★IN COMBUSTION UNIT FEED LINES

that are subject to vibration, heat, expansion and contraction, Eclipse Seamless Metal Hose has proven its stamina.

★IN BOILER TUBE CLEANER HOS

Eclipse Seamless Metal Hose has the flexibi of rubber *but* has the ability to withstand rough wear from tube edges.

★IN MANY OTHER APPLICATION

such as flexible connections, lubricating lines, vibration eliminators, etc., Eclipse H is useful in carrying all kinds of liquids gases, and in a wide variety of other ap cations.

DATA

Monel hose stocked in sizes from ⅛" to 2" I.D.
Steel hose can be produced with I.D. up to 40".
In addition to Monel, other alloyed tube stock can be obtained.
Eclipse Metal Hose is made in two degrees of pitch, normal and close. Also available with outer jackets of wire braiding or spiral metal.

Send for free Bulletin H201-935

ECLIPSE AVIATION

SEAMLESS FLEXIBL METAL HOS

Manufactured and sold by

THE INVISIBLE CREW Bendix AVIATION CORPORATION

4704 Wissahickon Ave.—Phila. Div.

GIVE 'EM ALL THEY NEED

. . . and more

THOSE fellows on our fighting fronts aren't asking a lot . . . and they're *giving* everything. To provide them with fighting equipment is a privilege as well as a duty.

One way to help, here at home, is to practise strict conservation. Buy the best and longest-lasting tools and equipment. Take care of everything and drain the last ounce of use from the things you use. That frees our factories, workers, and materials. It turns them loose to provide the weapons of war.

Buy to Last and *Save to Win* is a vital policy today. It's another step in winning the war . . . and pays dividends in extra use from all equipment.

Exide
BATTERIES FOR CRANKING DIESEL ENGINES

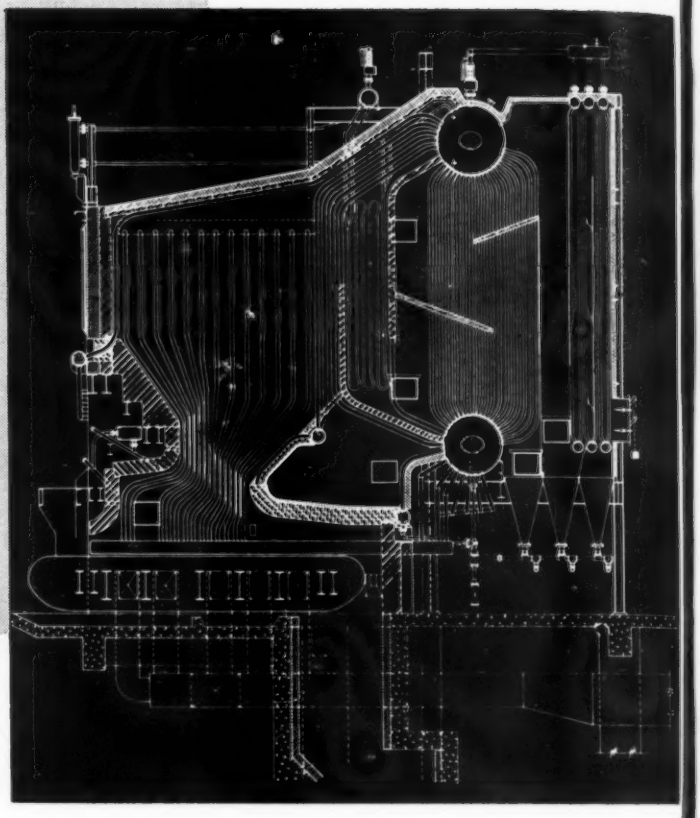
These rules of battery conservation help Save to Win

1. Keep adding approved water at regular intervals. Most local water is safe. Ask us if yours is safe.
2. Keep the top of the battery and battery container clean and dry at all times. This will assure maximum protection of the inner parts.
3. Keep the battery fully charged—but avoid excessive over-charge. A storage battery will last longer when charged at its proper voltage.
4. Record water additions, voltage, and gravity readings. Don't trust your memory. Write down a complete record of your battery's life history. Compare readings.

If you wish more detailed information, or have a special battery problem, don't hesitate to write to Exide. We want you to get the long-life built into every Exide Battery. Ask for booklet Form 2399.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia
Exide Batteries of Canada, Limited, Toronto

Edge Moor
WATER TUBE BOILERS



This

MODERN 2-DRUM DESIGN IS A POPULAR TYPE IN THE POWER FIELD . . . . . .

★

★

★

The steam generating unit illustrated is designed to produce 68,000 pounds of steam per hour at 450 pounds pressure and at 760° F. final steam temperature. The design takes full advantage of water cooled walls and economizer equipment. Low grade bituminous coal is fired on a travelling grate stoker.

Built-in features of rapid steaming, high overload capacity, high efficiency and accessibility and easy maintenance are included in this plant. Produced for a wartime project, Edge Moor quality of workmanship insures many years of satisfactory operation.

Every hour 91,000,000 pounds of steam are being currently generated with Edge Moor boilers to keep production rolling for victory.

Edge Moor installations are constantly increasing in number and scope of service. Our engineers will cooperate with you on your requirements.

Edge Moor IRON WORKS, INC. EDGE MOOR DELAWARE

NEW YORK—30 ROCKEFELLER PLAZA . . . CHICAGO—#1 NORTH LA SALLE STREET

IN CANADA—UNITED STEEL CORPORATION, LIMITED, TORONTO

Protected against delays in COAL DELIVERIES

One of the larger public utilities wanted to be secure against the possibility that adverse conditions—natural or otherwise—would deprive them of an adequate coal supply for their power plants.

They called in ROBINS.

On an idle site a quay was built, spur tracks were laid, two 1600 ft. belt conveyors were installed, a bridge (with integral sizing units) was erected—and a stockpile of nearly 250,000 tons was built up. Now they have no fear of running short of coal. Nor is there any danger of spontaneous combustion in the pile.

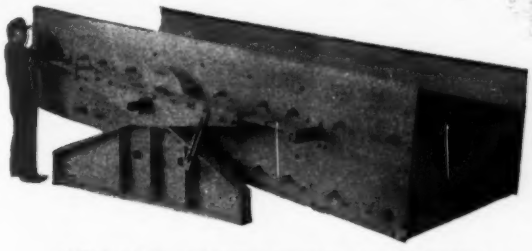
This entire project was engineered, manufactured and erected by ROBINS. Have you a bulk materials handling problem?

FOR MATERIAL AID IN MATERIALS HANDLING ..... ***It's ROBINS***

ARE YOU THINKING OF

Converting to Coal?

Discuss the matter with a ROBINS Field Engineer. The technique for storing and handling coal is different from oil. A number of shortcuts and economies are possible—a few precautions are advisable. Consultation with a ROBINS Field Engineer—from any of our ten offices—involves you in neither cost nor obligation.



ROBINS VIBRATING SCREENS

SHARP SIZING • HIGH CAPACITY
SIMPLE DESIGN • SMOOTH OPERATION

Sizes and types for every purpose • *Gyrex* for heavy duty sizing and scalping • *Vibrex* for fine sizing; has high speed, unbalanced vibrator • *Eliptex* for horizontal installations and dewatering; has elliptical throw, counter to travel of material • *Contractors'* for accurate sizing and salvaging of aggregates, cinders, coal, coke and other materials • *Hydrex* for clarifying liquids and dewatering solids. Bulletins on request.

ROBINS makes

Belts, Conveyor • Boat Mechanisms, Self-Unloading • Brakes, Holdback • Bridges, Reclaiming and Stocking (Man Trolley and Rope System) • Brush Outfits, Conveyor • Buckets, Grab • Cableways • Car Retarders • Castings, Gray Iron and NI-HARD • Chutes, Vibrating Transfer • Collars • Conveyors, Belt • Conveyors, Pivoted Bucket • Couplings • Crusher Rolls, NI-HARD • Crushers, Coal and Coke • Dumpers, Car • Elevators, Bucket • Feeders, Apron, Belt, Reciprocating and Roll • Gates, Radial, Rolling and Sliding (Single and Double Cutoff) • Gears • Haulage Systems, Car and Barge • Hoists, Dragline and Stackline • Hoists, Skip • Hoisting Engines • Idlers, Conveyor—Troughing, Training, Return, Rubberdisc • Pulleys, Conveyor • Rail Clamps • Reclaiming Machines • Rigs, Special • Screen Cloth, Improved *Super Gyraloy* • Screens, *Gyrex, Vibrex, Eliptex,* Liquid • Shakeouts, Foundry • Sprockets • Take-ups • Towers, Loading and Unloading • Trippers • Weigh Larries • Winches • Windlasses

ENGINEERS • MANUFACTURERS • ERECTORS

ROBINS
CONVEYORS
INCORPORATED
(ROBINS CONVEYING BELT CO.)
PASSAIC • NEW JERSEY

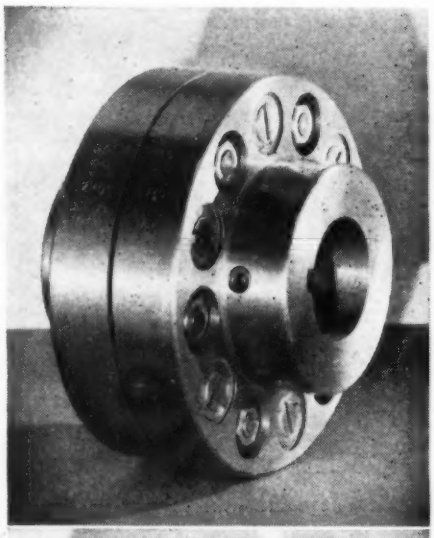
MATERIALS HANDLING MACHINERY

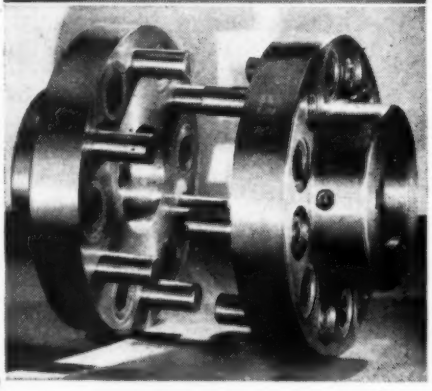
YOU TRY IT...

Take a couple of pencils and try to hold them in perfect alignment without touching each other for 10 seconds and see what happens! It will give you a quick demonstration of the fact that it is impossible to maintain perfect alignment between the shafts of direct-connected machines. Ajax Flexible Couplings provide a positive but resilient connection between driving and driven shafts. They make it possible for each shaft to rotate around its own axis without creating vibration, chatter, strain on bearings, drag, power loss, reversal of torque and other detrimental factors.

Ajax interlocking drive studs held by rubber bushed, graphited-bronze bearings assure maximum flexibility, quiet operation, and complete elimination of lubrication problems.

Make the 10 second "pencil test"—then write for Facts on Ajax Flexible Couplings.

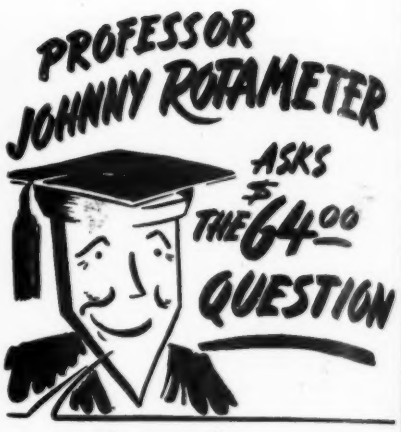




AJAX

Incorporated 1920

FLEXIBLE COUPLING CO.
WESTFIELD, N.Y.



What flow rate instrument combines these features?

- .....high visibility
- .....instantaneous response
- .....low, constant pressure drop
- .....10" to 24" scale length
- .....evenly-spaced scale divisions
- .....20 to 1 flow range
- .....low maintenance
- .....ability to measure any corrosive gas or liquid
- .....overall accuracies as high as 99.8%

The answer is obvious—only the rotameter can offer all of these advantages in one instrument.

If you are not utilizing the rotameter to your fullest benefit, it is perhaps because you have not realized yet how superior it is to fixed orifice meters for flow rate measurement. Furthermore, the scope of the rotameter is being widened constantly by our research and by our experience in its application to industry. Today, for instance, the remote recording and automatically controlling rotameter is a standard item with us.

Put yourself abreast of the latest rotameter developments by writing for our booklet No. 10-A entitled "A New Trend in Flow Rate Measurement." It is concise and worth reading. We will gladly send it to you without any obligation whatsoever. Fischer & Porter Co., 606 County Line Road, Hatboro, Penna.

Correct Solution to Power Piping Problems

Whatever your piping problem may be, Navco is in position to help you. The knowledge which we have gained in the past thirty-five years has not been confined to design and fabrication alone. It includes a wide field of experience in erecting and testing Piping Systems for every service.

NATIONAL VALVE & MANUFACTURING CO.
PITTSBURGH, PA.

NAVCO

NAVCO PIPING

OVER 30 YEARS' EXPERIENCE

IN DESIGNING AND MANUFACTURING HEAT EXCHANGERS OF ALL TYPES

WHITLOCK Engineers gladly cooperate with customers in the design of heat exchangers—assuring a design exactly suited to the needs of the particular project—at minimum cost.

MANY factors influence the design and construction of heat exchangers. It is essential that the manufacturer you select shall have had a wealth of experience in such work.

WHITLOCK has had that experience supplying heat exchangers to many of the country's largest users of such equipment. Designs vary to suit conditions—straight tube, U-tube, coil-tube; with a variety of baffle constructions. Materials used cover the range of usual and unusual metals and alloys. Construction depends upon operating requirements, temperatures and pressure.

THE WHITLOCK MANUFACTURING COMPANY

46 South St., Elmwood, Hartford, Conn.

District Offices in NEW YORK, BOSTON, CHICAGO, PHILADELPHIA, DETROIT, RICHMOND

NEW—48 Pages of Maintenance and Production Tools

Electrical Maintenance Equipment includes Commstones, Undercutters, Mica Saws. Also includes Rotary Files and Burs, Screw Slotting Saws and Safety Equipment.

Write for a copy of this No. 24 Catalog.

THE MARTINDALE ELECTRIC CO.
1385 HIRD AVE. CLEVELAND, OHIO

PIPE BENDER

for iron and steel pipe from 3/8" to 4½"

- *No Heating*
- *No Filling*
- *No Kinks*
- *No Wrinkles*

The NEW TIME-SAVING, LABOR-SAVING MACHINE that ELIMINATES EXTRA WORK!

Why use fittings, elbows, etc., in places where they are not necessary? Make your job easier—faster—less complicated and at the same time save critical materials.

Those who use TAL'S PRESTAL once, never again go back to old, time-wasting methods.

Use it for all types of plumbing and heating.

TAL'S PRESTAL is portable — goes along on every job—is so easy to operate that even "green hands" will turn out smooth, wrinkle-free bends in one single, simple operation requiring only a few minutes.

SMOOTHNESS OF BENDS: No breaking of pipe due to scientific development of bending formers. No job too complicated.

Obtainable in three different sizes.
Meets U. S. Navy, Army & Maritime Comm. Specifications.
Write today for circular giving complete description.

TAL'S PRESTAL BENDER, Inc. Dept. P6 Milwaukee, Wisc.

We Made a Mole Hill Out of a Mountain

Bigelow-Liptak engineering and construction methods solved the problem of directing large volumes of acid-laden, low temperature gases from a series of process furnaces to an exhaust chimney.

THE PROBLEM that faced one of the country's largest copper smelters was a tough one. A satisfactory and economical means had to be developed and constructed for carrying off large volumes of acid-laden gases from process furnaces to a chimney.

Due to the enormous volume of gases being released, any flue for handling them would necessarily involve large exposed areas. Such a flue, necessary for directing the gases, would have to be designed for maximum wind load and made weather proof. Also it would have to be air-tight to maintain a relatively high draft or negative pressure.

In order to sustain a temperature high enough at the base of the stack to create the necessary draft, a method for assuring a reasonably low conduction heat loss for the entire flue had to be worked out.

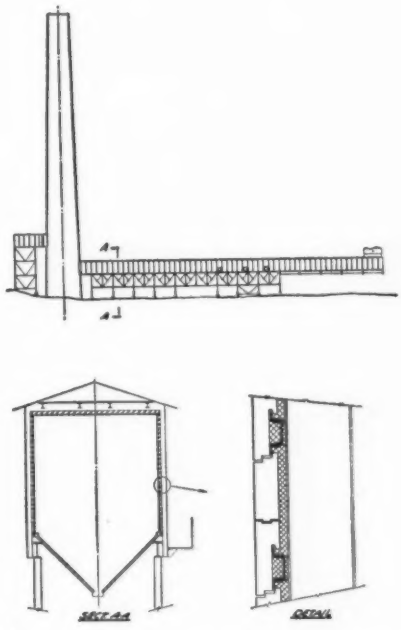
Another factor added to the problem. Adequate provisions had to be made for taking care of the great amount of thermal expansion that would naturally occur in a flue of this length. In designing the flue, means of compensating for this expansion would have to be incorporated in the design.

As should be the case, costs had to be an important consideration. Any passage devised would have definite price limitations and the design had to be economical.

The Solution

Bigelow-Liptak engineers visited the job. A complete survey of the problem and all its factors was made and studied. Preliminary drawings for the general design of a flue were made right at the job site. Later, back in the general office complete and detailed drawings were developed and studied by the Bigelow-Liptak engineering staff. A thorough analysis was made of the thermo-dynamics, the mechanics of materials and the ceramics.

As a result of this careful analysis and study, a thoroughly satisfactory and economical means was worked out for directing the acid-laden gases from the furnaces to an exhaust chimney. Recommendations were prepared and cross section drawings of the entire flue — as shown — were submitted.



Unit-Suspended side walls and arches were used for the 350 feet long flue areas. Special acid-resisting refractories were selected. Because of experience, Bigelow-Liptak knew that this type of acid-resisting tile should be manufactured on extrusion machines. This was important in designing the tile, as all special shapes would have to be designed to conform to this process without sacrificing any of the advantages of Unit-Suspended construction. Air tightness and low heat conduction losses, being a natural feature of Bigelow-Liptak Unit-Suspended construction, were easily incorporated into the design, once the major problem had been solved.

Bigelow-Liptak's exclusive designs made possible an uninterrupted weather proof insulation shield or encasement —thereby eliminating the need of critical steel plate—a factor of considerable importance today.

Because of the acid in the gases, ordinary expansion joints could not be used to provide for the expansion and contraction. A special fibre glass had to be employed.

By applying Bigelow-Liptak engineering skill and principles, the problem of finding a satisfactory means of transferring acid-laden gases to an exhaust chimney, was solved.

What This Means To You

The significance of this problem and its complete solution by Bigelow-Liptak is much greater than any resemblance it may have to any of your problems. It serves to demonstrate the value you may receive by taking your problems to Bigelow-Liptak regardless of their type or size. Bigelow-Liptak's wide experience in designing enclosures includes every type of problem having to do with thermo-dynamics, ceramics and mechanics of materials. With Bigelow-Liptak there is no standard or set solution for every case. Individualized engineering, based on years of experience and sound engineering principles, is applied towards giving the customer the best and most economical solution to his particular needs. Our policy is to give first and foremost consideration to the needs of the user.

Engineering Information No Obligation

Our engineering staff will be glad to send you interesting catalogs or tell you how you could secure increased service and economy by the use of Bigelow-Liptak Unit-Suspended walls and arches in your plant. Write today.
Bigelow-Liptak Corporation
Curtis Building
Detroit

BIGELOW LIPTAK Corporation

Unit-Suspended Walls + Arches

The Key to Operating Economy
BIGELOW-LIPTAK CORPORATION
DIVISION A. P. GREEN FIRE BRICK CO.
Curtis Building
DETROIT

The
Supporting Cast
in the
GREATEST PRODUCTION
IN WORLD'S HISTORY
POWELL

In the colossal job now being accomplished by American industry, every man, every machine, every piece of equipment plays an important part. And every one knows that Industry can give no better performance than the valves which control the fluids or vapors that give Life to Industry. The supporting cast in the greatest production the world has ever seen consists of—Valves. To this role, Powell brings the KNOW-HOW of 97 years of specialization in valve engineering . . . specialization in valve design, function, application, conservation . . . specialization in improvement of workmanship and materials through a period of almost a century. That's why today Powell Valves are giving a faultless performance in the epic drama of American wartime production.

The Wm. Powell Company

Dependable Valves since 1846

Cincinnati, Ohio

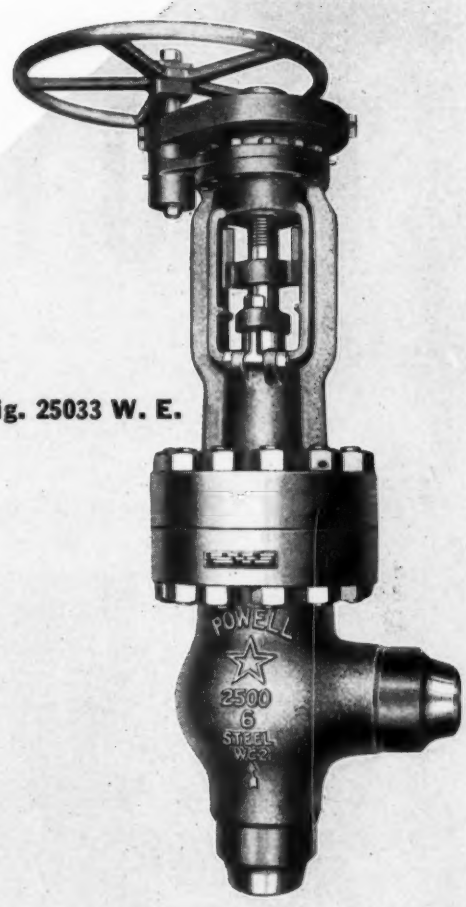


Fig. 25033 W. E.

Fig. 25033 W. E.—Class 2500 pound Cast Steel Angle Valve with welding ends, outside screw rising stem, bolted flanged yoke and spur gears. Can be equipped with bevel gears and motor operator. Regularly furnished with semi-cone seat and disc but for special throttling service can be furnished with piston-guided disc. (Fig. 25028 W. E.)

Fig. 1331 W. E.—Class 1500 pound Cast Steel Globe Valve with welding ends, outside screw rising stem and bolted flanged yoke. Sizes 3" and larger are regularly furnished with Anti-friction bearing yoke and spur gears.

Fig. 9003 W. E.—Class 900 pound Cast Steel Gate Valve with welding ends, outside screw rising stem and bolted flanged yoke. Seat and disc are hard faced with Stellite.

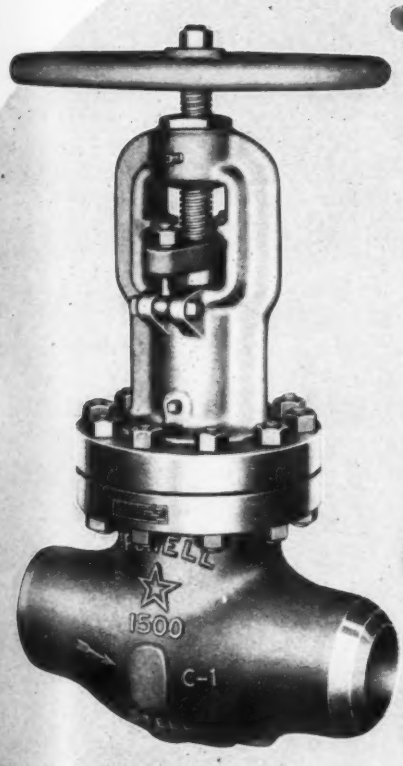


Fig. 1331 W. E.

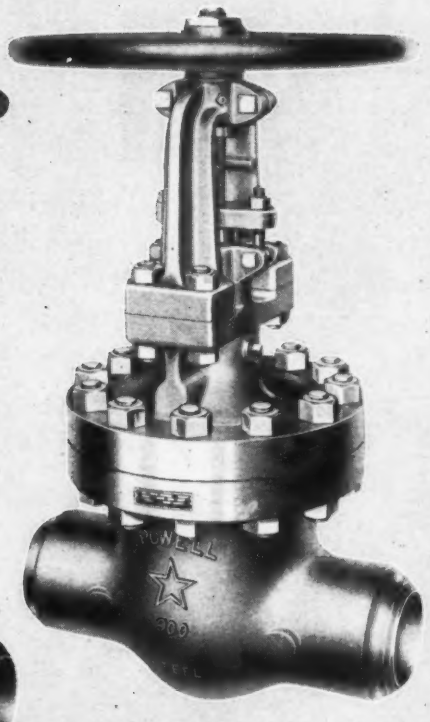
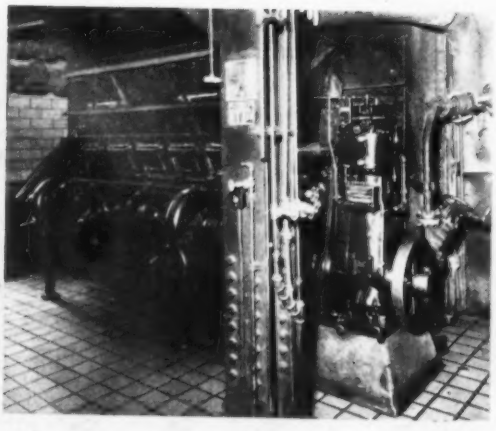
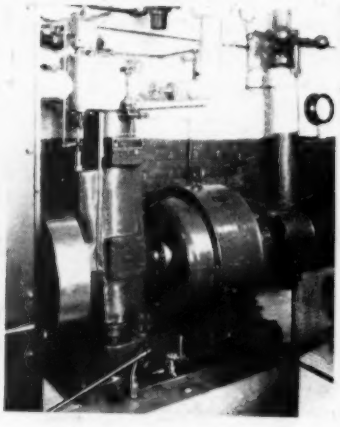


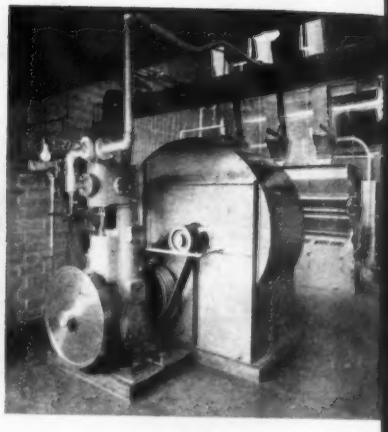
Fig. 9003 W. E.

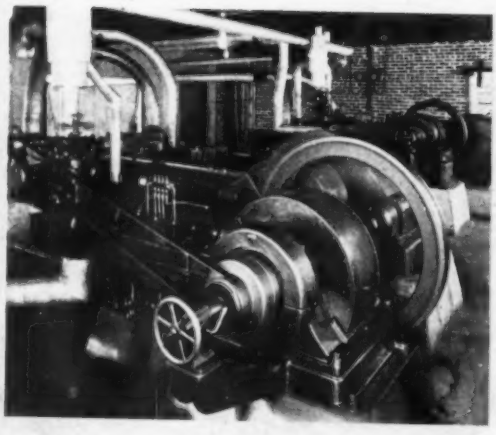
VALVES

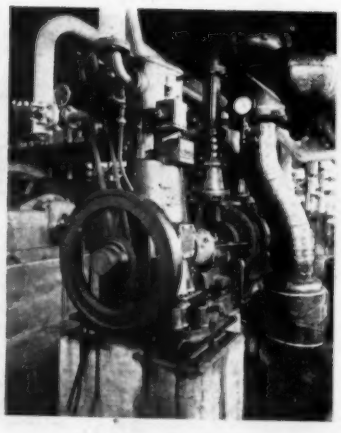
TROY-ENGBERG

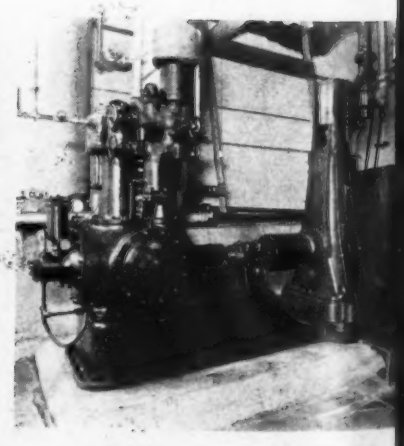












TROY-

STEAM ENGINE

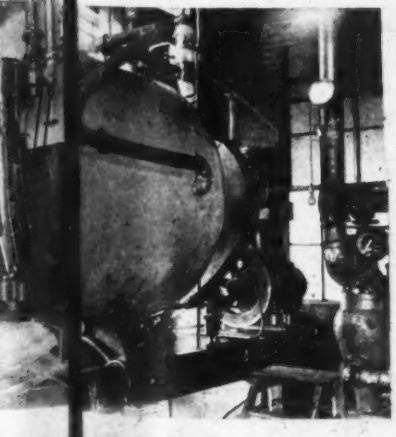
1...the drive that quickly returns its cost often within a year or two

2...the drive that offers several excellent drive characteristics

3...the drive that is noted for its dependability

OUTSTANDING economy . . . flexibility, wide speed range, high-starting torque, heavy overload capacity . . . year in, year out operation without need for major repairs! That's the record of thousands of Troy-Engberg Steam Engines operating today in power and process plants throughout the country.

It's no mystery why many oil refineries use Troy-Engbergs for driving charging pumps. Nor was it a surprise when one of the largest public utilities recently installed 24 Troy-Engberg Engines to drive its 48 stokers. And there is significance in the fact that hundreds of Liberty Ships have three Troy-Engberg Generating Sets in their engine rooms.



If your plant conditions are right, the Troy-Engberg Steam Engine is the most modern and economical drive for your stoker, pump, compressor, generator, blower or fan. Don't fail to investigate it when you need such a drive . . . and can get proper priority.

TROY ENGINE & MACHINE CO.

Established 1870

1486 Railroad Avenue **Troy, Pennsylvania**

Y-ENGBERG *STEAM ENGINES . . . GENERATING SETS*

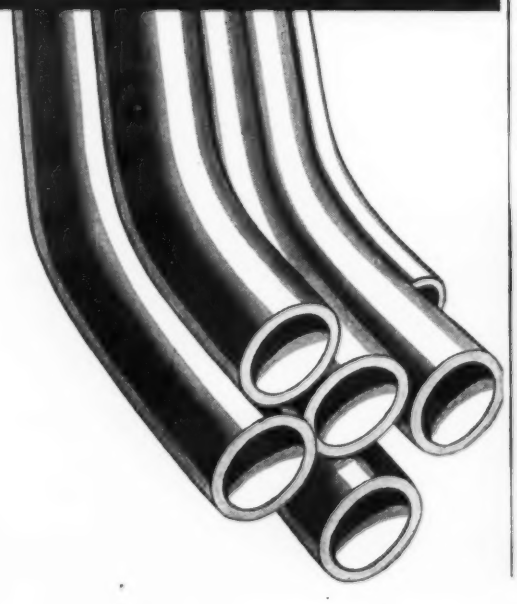
Here's an organization with more than 23 years experience in the fabrication of all sizes and all makes of boiler tubes to meet A. S. M. E. boiler specifications. Our complete facilities give you boiler tubes as you want them, when you want them — direct your next order to us for the "world's fastest boiler tube service."

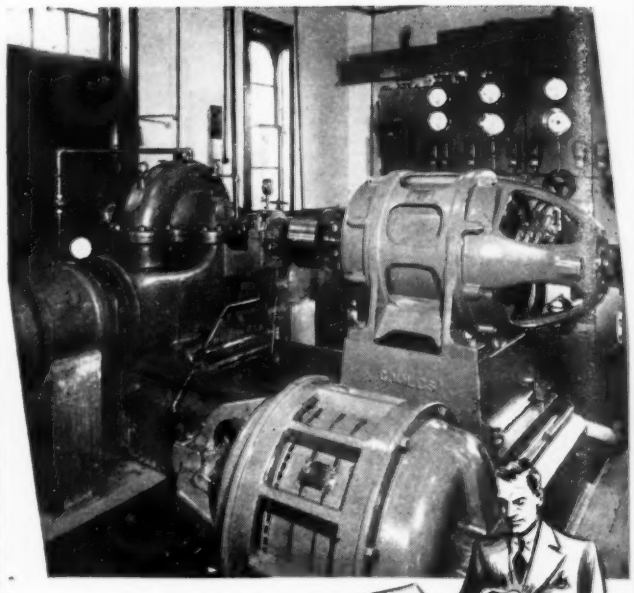
BOILER TUBE COMPANY OF AMERICA

Main Office & Works • PITTSBURGH, PA.

PITTSBURGH • NEW YORK • PHILADELPHIA • CHICAGO

FRED S. RENAULD & CO. • LOS ANGELES





"There's where we will use a

GOULDS PUMP!!"

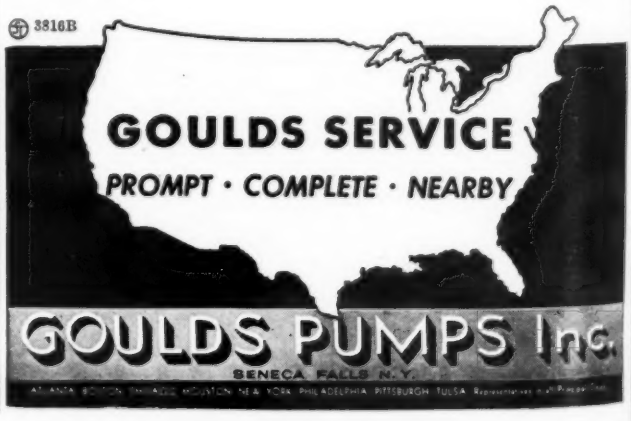
Experienced power plant engineers know the value of dependable equipment — know how important it is to their overall plant operation to have pumps, that will run at maximum efficiency over long periods with complete freedom from shut downs—at a minimum of maintenance expense.

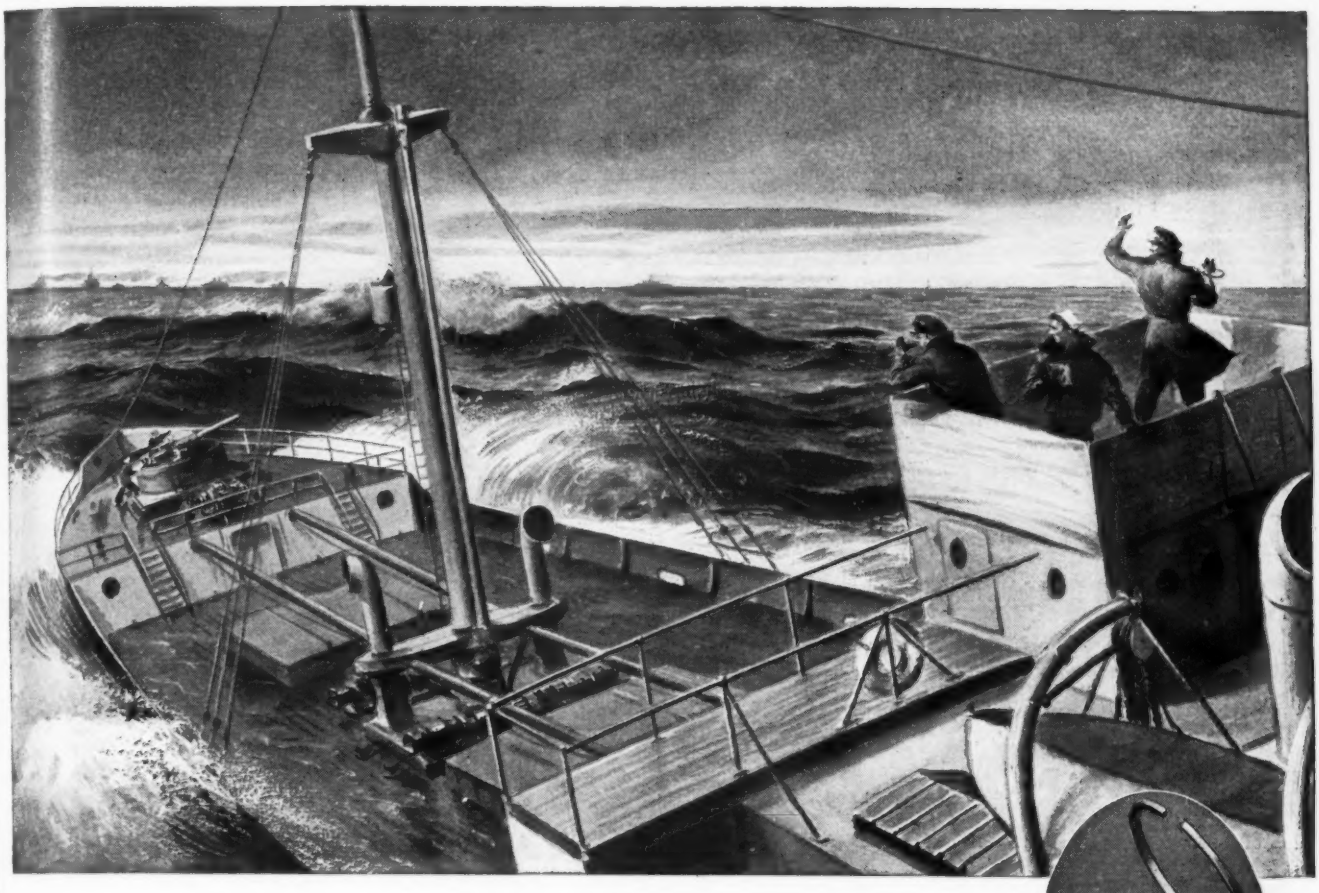
Many have applied just such knowledge to their pump purchases. These are the engineers who know the wide range of the Goulds line, and that there's a standard Goulds pump for practically every industrial pumping job, even for many special applications.

To help in the choice of the right pump for any given job, the Goulds organization, makers of pumps since 1848, offers *every pump user* a comprehensive reference file of information.

Write for your set of these Goulds Pump Data Sheets—supplied in a convenient portfolio. They contain technical advice on the installation, operation and maintenance of new pumps as well as vital, practical suggestions for lengthening the life of existing pumping equipment.

3816B





PEDRICK PRECISION *Provides Extra Power*

WHEN MEETING THE CONVOY SPELLS LIFE ITSELF . . . .

• In the nerve-tingling routine of outrunning U-boats, Pedrick *precisioneered* piston rings are helping America win this war —just as they are delivering that essential extra power and extra life to fighting-planes above, to submarines below, and to the thousands of stationary and mobile horsepower so essential to a United Nations victory.

Precisioneered! Precisely shaped on intricate machines to engineering designs that are right for the specific job they'll fill! Made and fitted to give and hold compression, to save and keep saving oil, to get the extra speed and extra punch from every drop of fuel. Small wonder that producers and servicemen alike, on everything from giant Diesel to tiny compressor, are specifying Pedrick in ever-growing numbers. WILKENING MANUFACTURING CO., Philadelphia. *In Canada:* Wilkening Manufacturing Co. (Canada), Ltd., Toronto.

TO ENGINEERS & MAINTENANCE MEN

To you who need, in the piston rings you use, absolutely correct and lasting tension, accuracy, flatness, fit, quick seating and long life, Pedrick has the answer. Our latest catalog shows how Pedrick makes *precisioneered* piston rings for superior performance and gives recommended installations for various types of pistons and service conditions. Write for your free copy.

Pedrick

precisioneered **PISTON RINGS**

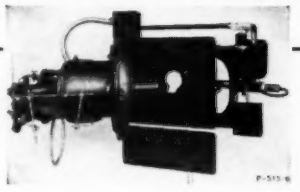
NATIONAL AIROIL BURNER EQUIPMENT

for Burning Oil and Gas...Efficiently

Universal Combustion Unit. For oil or gas.

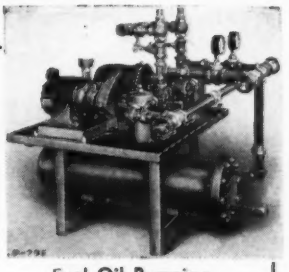
Steam Atomizing Oil Burner Type S A

Low Air Pressuure Type Oil Burner.



Rotary Oil Burner

NATIONAL AIROIL BURNER

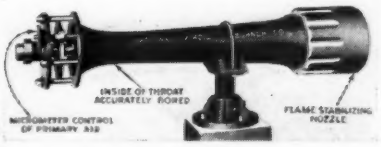


Fuel Oil Pumping and Heating Unit.

9030 231 232 9125

Indicating Oil and Steam Control Valves

Steam or air atomizing oil burner. Type S A L Large Capacity



Airovent Gas Burner. Venturi Inspirating Type.

For information on any of these . . . write

NATIONAL AIROIL BURNER

COMPANY, INCORPORATED
1250 East Sedgley Avenue
PHILADELPHIA, PENNA.

Other Products: Large Capacity Burners for Steam Generators, etc.; Combination Gas and Oil Burners; Furnace Peepholes; Refractory Burner Blocks in many sizes.

For Safe Boiler Operation

The Genuine **Squires**

Boiler Feed Water Controller

will maintain a constant water level in your boilers and will feed them in proportion to the evaporation.

Write for Catalog A-12 now

The feed valve is operated by boiler pressure —insuring positive functioning.

Trade Mark Reg. U. S. Patent Office

THE C. E. SQUIRES COMPANY

East 40th St. and Kelley Ave., Cleveland, Ohio

NATIONAL Classified Advertising —at your service

for bringing business needs or "opportunities" to the attention of men associated in administrative, executive, management, sales and responsible technical, engineering and operating capacities with the industries served by McGraw-Hill publications:

The SEARCHLIGHT SECTIONS *(Classified Advertising)* of

American Machinist
Aviation
Bus Transportation
Business Week
Chemical and Metallurgical Engineering
Coal Age
Construction Methods
Electrical Contracting
Electrical Merchandising
Electrical World
Electronics
Engineering News-Record
Engineering and Mining Journal
E & M J Markets
Factory Management and Maintenance
Food Industries
Power
Product Engineering
Textile World

For advertising rates or other information address the Departmental Staff

McGRAW-HILL PUBLICATIONS

330 W. 42nd St., New York, N. Y.

"Ask the man who runs one"

★ The time-honored Packard slogan can be applied with real force and significance to the machinery of war. Whether it's a jeep, a tank, a plane, or a battleship, just "ask the man who runs one". From all reports his verdict will be: "It's O.K., Uncle Sam; It's got what it takes!"

In wartime such a testimonial is not for one manufacturer, but for all who had a hand in the achievement. The products of peace wear the bright name plate of a particular manufacturer; in war, the individual must be forgotten. The tank or plane is not a Buick or Chrysler or Ford. It is just a "U.S.A." —a product of a large portion of U.S. industry. The individual's pride of achievement must give place to something greater — the collective pride in masterpieces achieved by all industry working together in an All-American team.

Along with thousands of other manufacturers, James P. Marsh Corporation is on that team. True, the gauges, dial thermometers and other instruments we are furnishing are not shot at enemy positions or dropped on Tojo's palace. But they *are* an essential part of almost anything you can mention for directly or indirectly attaining such objectives.

They have simply a little job in a big war; but you who know Marsh Instruments and heating specialties will agree that there is no equipment more capable of handling the jobs for which it has been chosen.

JAS. P. MARSH CORP., 2075 Southport Avenue, Chicago, Ill.

The Gauge with the "RECALIBRATOR"

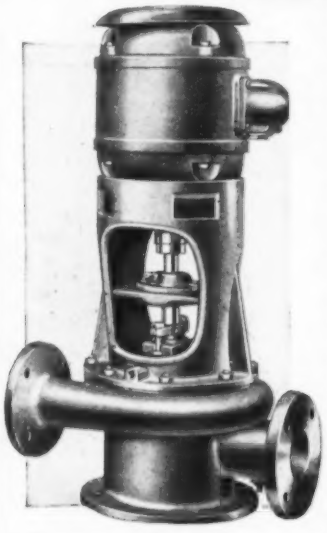
A gauge built to Marsh Standards is not likely to be knocked out of adjustment. But if it is, the Marsh "Recalibrator" will quickly restore its accuracy. Simply turn the "Recalibrator" screw until the pointer is at zero when not under pressure. The gauge will then be right at all points on the dial. Unlike other methods of resetting, the "Recalibrator" gets at the root of the error—re-establishes the relation of the bourdon tube to the movement—actually *re-calibrates* the gauge.

MARSH GAUGES

DIAL THERMOMETERS ★ RECORDERS ★ HEATING SPECIALTIES

ECONOMY PUMPS

ADAPTABLE
DURABLE
DEPENDABLE



● The new Economy pump for use in hot or cold water circulation, brine circulation, sprinkler systems, boiler feeding, pressure boosting, etc. For services from 10 to 500 GPM, with heads up to 225 feet.

Rugged construction. Motor is registered high above mounting surface away from splash and dirt. In the event of motor failure any comparable stock motor can be easily adapted. Complete rotor assembly, including motor, can be removed and replaced quickly without disturbing suction or discharge piping.

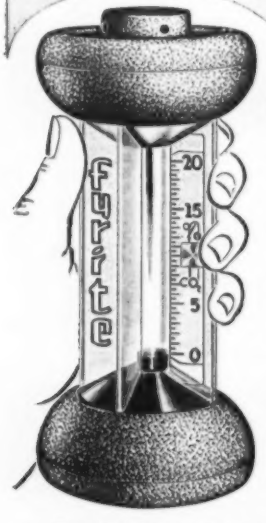
FOR DETAILED INFORMATION, SEND FOR CATALOG D2-1042.

ECONOMY PUMPS, INC.
1020 WELLER AVE.
HAMILTON . . . . . OHIO

STRETCH STEAMING CAPACITY
. . . . . for Greater War Production

Portable **FYRITE CO_2**
"ORSAT" ANALYZER
Instantly Reveals
FUEL WASTE

Makes ACCURATE Flue Gas Tests EASY!



The amazingly simplified FYRITE "Orsat" CO_2 Analyzer is a practical aid in stretching steaming capacity, cutting fuel consumption, and reducing furnace maintenance. The FYRITE makes flue gas tests easy—quickly indicating necessity of making adjustments that will secure the most efficient combustion. The FYRITE is easy to manipulate; accurate within ½ of 1% CO_2; spill-proof; cold-proof; rugged, durable, compact. More than 7000 are in use.

RETURN COUPON BELOW. *Obtain new bulletin on FYRITE and learn how to get immediate delivery under priority regulations.*

$18.50 COMPLETE WITH INDUSTRIAL TYPE FLUE FILTER

BACHARACH
Industrial Instrument Co.
7000 BENNETT ST.
PITTSBURGH, PA.

SEND BUL. 338 on *FYRITE "ORSAT"*

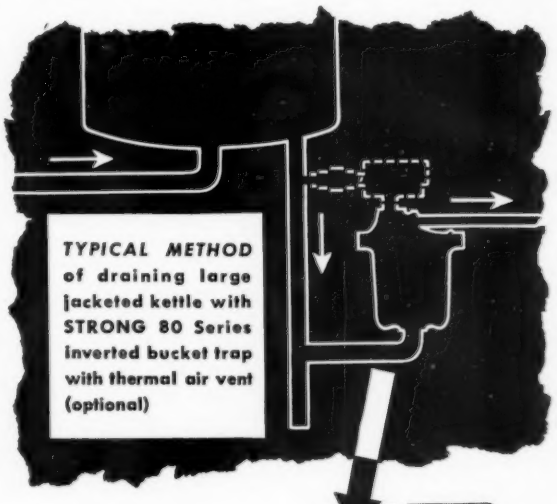
Name _____

Address _____

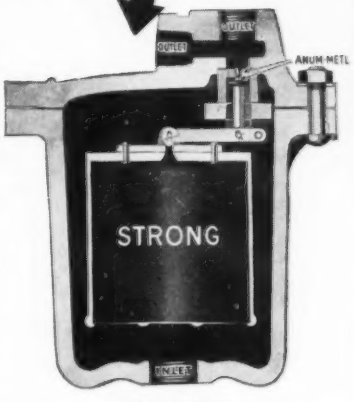
City _____ State _____ P

TRAP it RIGHT!

SPEED production...SAVE steam


TYPICAL METHOD of draining large jacketed kettle with STRONG 80 Series inverted bucket trap with thermal air vent (optional)

ANSWERS
by the people who build the *most complete* line of traps



80 Series Trap

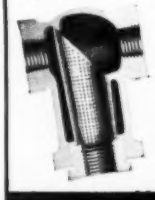
Strong inverted bucket traps are superior for draining steam kettles, unit heaters, dry kilns, and heat exchangers. They handle large quantities of air and condensate. Turbulence during discharge helps pass scale or dirt. Strong's patented anti-balancing device assures full intermittent discharge even at low rates of condensation.

★ ★ ★

Completeness of the Strong line enables us to recommend exactly the type and size you need—open or inverted bucket, closed float, float-and-thermostatic (blast), etc.—forged, welded, cast and semi-steel construction. Send your problems to Strong, Carlisle & Hammond Co., Cleveland, Ohio.

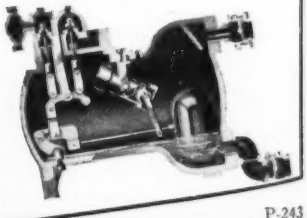
OTHER STRONG STEAM SPECIALTIES

STRAINERS



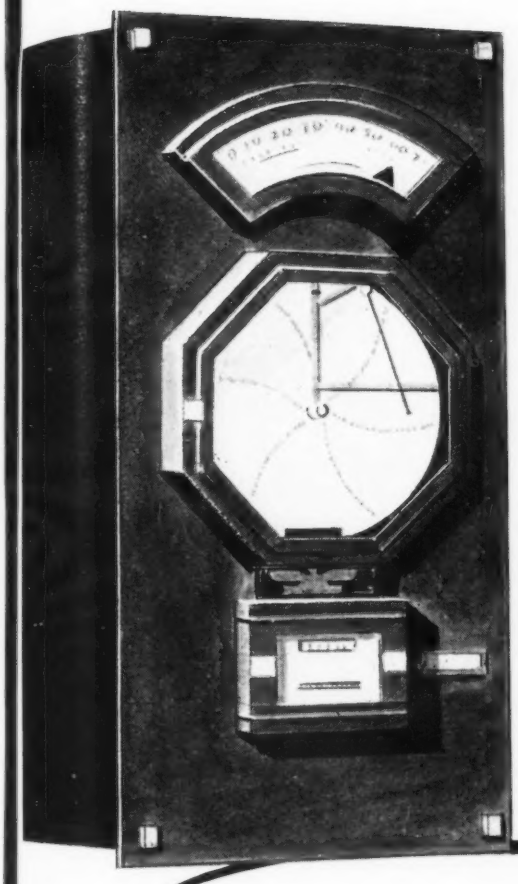
REDUCING VALVES

VACUUM AND LIFTING TRAPS



P-243

STRONG
STEAM SPECIALTIES

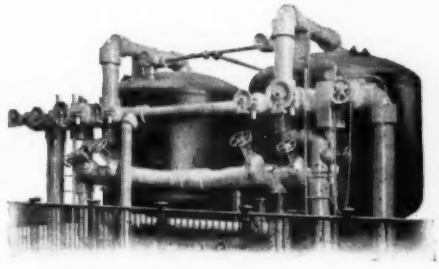


"Sure, we're carrying heavy loads, but GOOD WATER protects our boilers"

Scale and corrosion in boilers, steam lines and auxiliaries could cripple a power plant's war effort—might cause indefinite shut-downs if tubes could not be replaced. At thousands of war plants, Permutit prevents these troubles. Permutit removes the feedwater impurities that cause the damage. Writes one plant: "Inspection after a full season's operation shows boilers clean as new metal."

Permutit service covers every water conditioning process—including Zeo-Karb,* hot lime soda softeners, deaerating heater, silica removal, continuous blow-off equipment and the new demineralizing process. Let Permutit help *your* plant insure its continued contribution to war production. Write us about your water problem. The Permutit Company, Dept. A, 330 W. 42nd St., New York, N. Y. In Canada: Permutit Company of Canada, Ltd... Montreal..Toronto..Winnipeg..Calgary.

*Trademark Reg. U. S. Pat. Off.



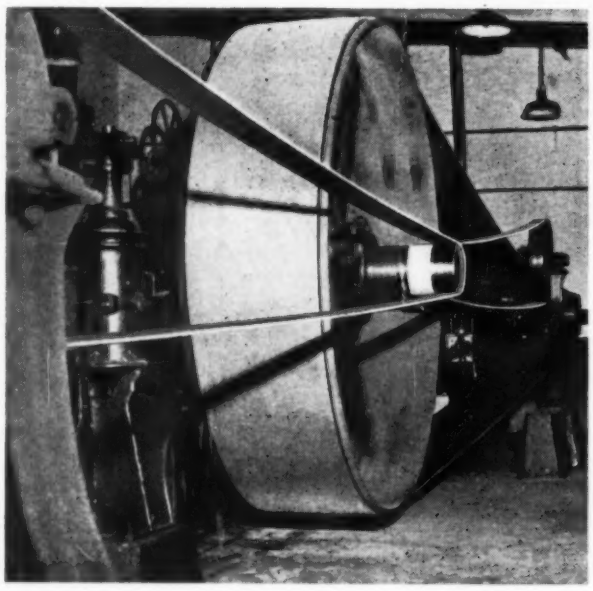
Permutit Zeo-Karb H water conditioner removes both hardness and bicarbonates from raw water. The effluent is reduced in total solids and alkalinity. The sulphate-carbonate ratio may be adjusted by mixing effluents from a Zeo-Karb H unit and a sodium Zeolite unit.

PERMUTIT

WATER CONDITIONING HEADQUARTERS

Serving Industry and the Armed Forces . . . with GOOD WATER

MORE PRODUCTION
without more machines



with Tannate leather belting

TANNATE maintains top speeds even at peak loads . . . Grips tightly, delivers more power even on unusual drives like the above, and keeps machines running smoothly with fewer shutdowns for drive maintenance.

And, high temperatures, moisture, machine oils and many chemicals have little effect on TANNATE leather belting. It will keep its grip and great strength even under severe operating conditions.

TANNATE will give you longer belt life and lower yearly belt cost. . . . It will increase output and give you more uniform work, less spoilage, fewer shutdowns and reduced unit costs.

Give TANNATE a trial in your plant—let it help you get peak efficiency from your machines.

Write for the new belt length calculator. Easy to use . . . accurate.

STEP UP PRODUCTION with
RHOADS
Tannate
WATERSHED
LEATHER BELTING

—Established 1702—

J. E. RHOADS & SONS

35 N. SIXTH ST., PHILADELPHIA, PA.

NEW YORK • CHICAGO • ATLANTA • CLEVELAND

How to design—
How to operate—
How to maintain—

A DIESEL OR GAS ENGINE POWER PLANT

This authoritative, practical book offers practising engineers all the information necessary to make economic studies for new installations. It conveys a sound appreciation and understanding of the functional capacities and limitations of required equipment in plant use. It brings you a thoroughly workable and comprehensive guide for the designing of new installations or additions to existing installations.

Just Published

DIESEL AND GAS ENGINE POWER PLANTS

THIS book focuses attention on internal-combustion engine *power plants;* it is not a treatise exclusively on engines. It covers the entire plant from its inception to completion, testing and operation. It takes up in detail the economics, design, operation and maintenance of such power plants. It includes up-to-date information which will enable the designer to estimate construction and operating costs of new plants, and it provides a standard of comparison for operating costs in existing plants. Mechanical and electrical features are presented from the viewpoint of both the plant designer and the operator.

Presents hard-to-find, up-to-date information on such topics as:—

—oil pipe-line pumping;
—power-plant structures;
—high-temperature and vapor-phase cooling;
—behavior of engine exhausts and air intakes;
—effect of variation in exhaust and air intake pressure on engine performance;
—performance and selection of electrical equipment and auxiliaries;
—supercharging;
—convertible and gas-diesel engines.

By GLENN C. BOYER

Associate Engineer, Burns & McDonnell Engineering Co.

447 pages, 6 x 9, 182 illustrations, $4.00

Which of these 20 chapters will be of most interest to you?

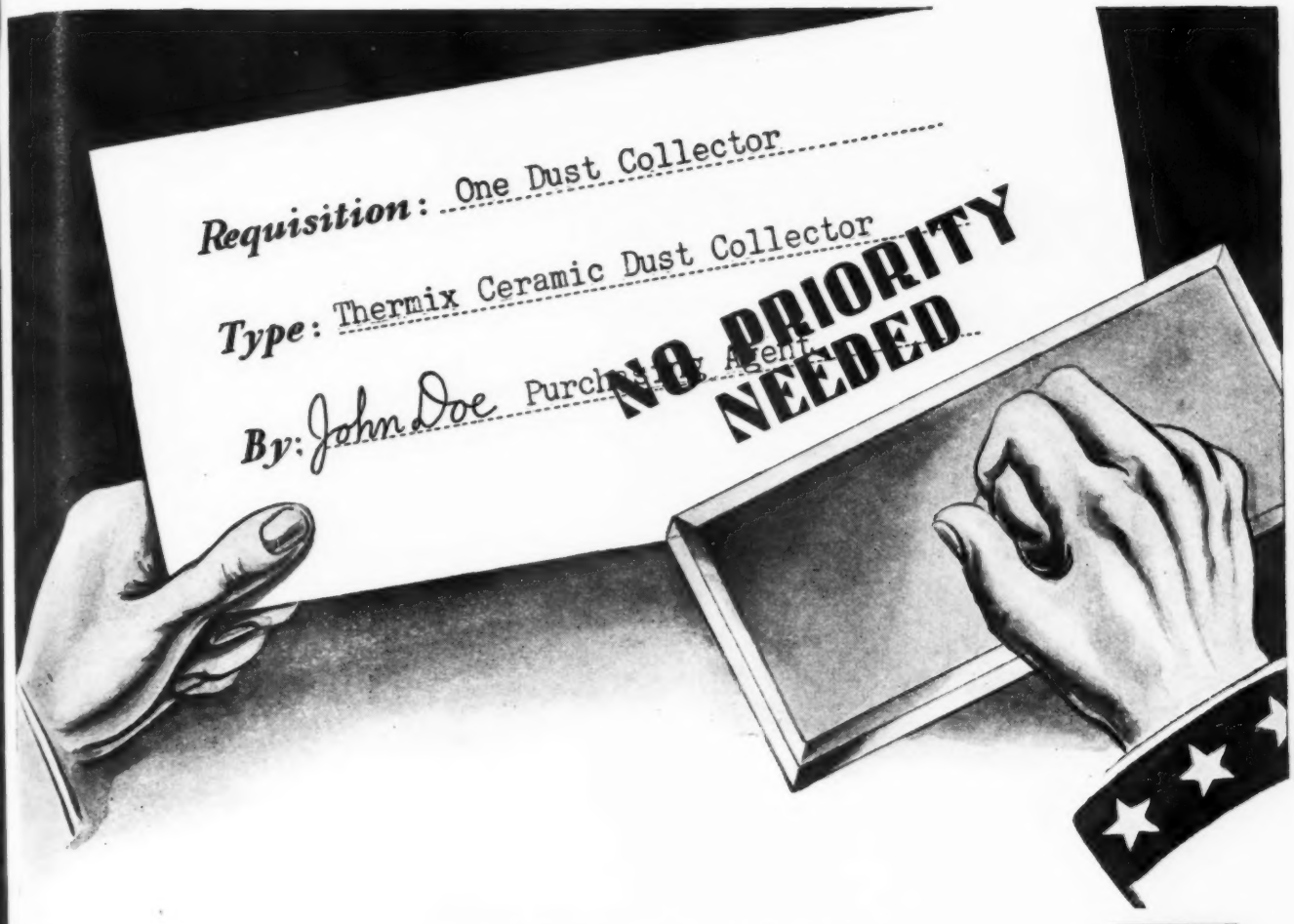
General Introduction
Variable Loads in Power Plants
Power-plant Performance
Economic Studies
The Industrial Power Plant
Pipe-line Pumping Stations
The Power-plant Building
Selecting the Engine
Fuel Oil
Gas Fuel
Lubrication
Engine Cooling
Intake and Exhaust Systems
Piping Systems
Waste-heat Recovery
Accessories
Maintenance
Electrical Equipment
Electrical System Layout
Equipment Testing

SEE BOOK 10 DAYS FREE
SEND THIS COUPON

McGraw-Hill Book Co., 330 West 42nd St., New York, N. Y.

Send me Boyer—Diesel and Gas Engine Power Plants for 10 days' examination on approval. In 10 days I will send $4.00 plus few cents postage or return book postpaid. (Postage paid on cash orders. Same return privilege.)

Name .....
Address .....
City and State .....
Position .....
Company ..... P. 6-43



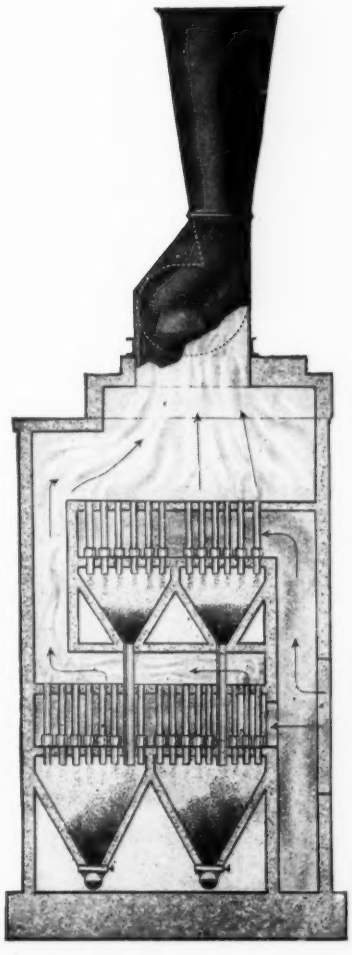
As a part of our war effort to conserve steel and enable you to get a dust collector without a priority, the Thermix is now constructed with tubes made of tough fire clay instead of steel.

These ceramic tubes are so rugged that they will withstand temperature changes and normal handling without breakage.

Another feature of these improved tubes is that they eliminate corrosion, reduce erosion and permit installation of the dust collector outside the plant, if desired, without any additional protecting structure.

Like the hundreds of steel Thermix Tubular Dust Collectors installed throughout the country during the past years, the Thermix CERAMIC Dust Collector assures high efficiency collection of fine dusts, powders and fly-ash.

Write for Bulletin and full particulars.



PRAT-DANIEL CORPORATION, Port Chester, N. Y.

General Sales Agents

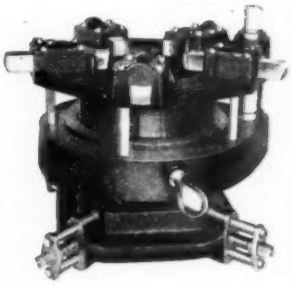
Thermix Engineering Co., Greenwich, Conn.

Representatives in Principal Cities

Thermix Ceramic DUST COLLECTOR

HELP!

The demand for large "TOLEDO" Stocks and Dies, Pipe Cutters and Power Drives is so great "TOLEDO" is unable to furnish in time for urgent requirements. If you have good used "TOLEDOS" in these larger sizes notify us at once and we will refer all inquiries to you. Please advise model numbers, capacity, etc. Put your idle "TOLEDO" tools to work and help the war effort.



THE TOLEDO PIPE THREADING MACHINE CO.
TOLEDO, OHIO — **NEW YORK OFFICE, No. 2 RECTOR ST.**

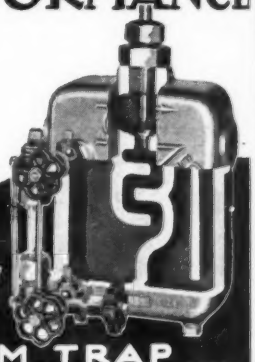
"TOLEDO"
TRADE-MARK REGISTERED U.S. PAT. OFFICE

BUY WAR BONDS AND WAR STAMPS

Excellence *in* DESIGN *and* PERFORMANCE

Continuous and Complete Condensate Elimination
Continuous and Complete Air Elimination
Water Gauge Gives Visual Indication of Operation
No By-Pass Required
No Moving Parts and No Annual Repair Bills
Fits Into the Line Like a Valve
Smaller Size Drainator Required Than Conventional Steam Trap

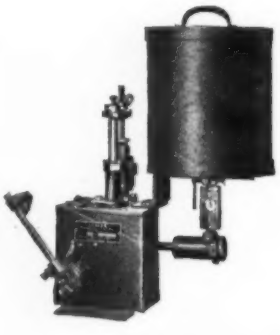
Get Bulletin 903-A



COE DRAINATOR
The ADVANCED STEAM TRAP *with* NO MOVING PARTS

The COE MFG. Company
501 BANK STREET • PAINESVILLE, OHIO

MANZEL FEEDERS
Insure UNIFORM Boiler Water Treatment!



Keep boilers operating at top efficiency by eliminating hit or miss methods of treating your feed water. Manzel Feeders are installed directly on the feed water pump and inject exactly the required amount of chemical on each pump stroke. Fully automatic, they require no attention once feed is set except to keep chemical tank supplied.

Amount of chemical injected is in exact proportion to volume of water entering the boiler. Manzels start, stop, speed up and slow down with the pump. Their simple design and sturdy construction insure years of trouble-free service. Thousands of boilers are protected by Manzel Feeders.

WRITE FOR BULLETIN

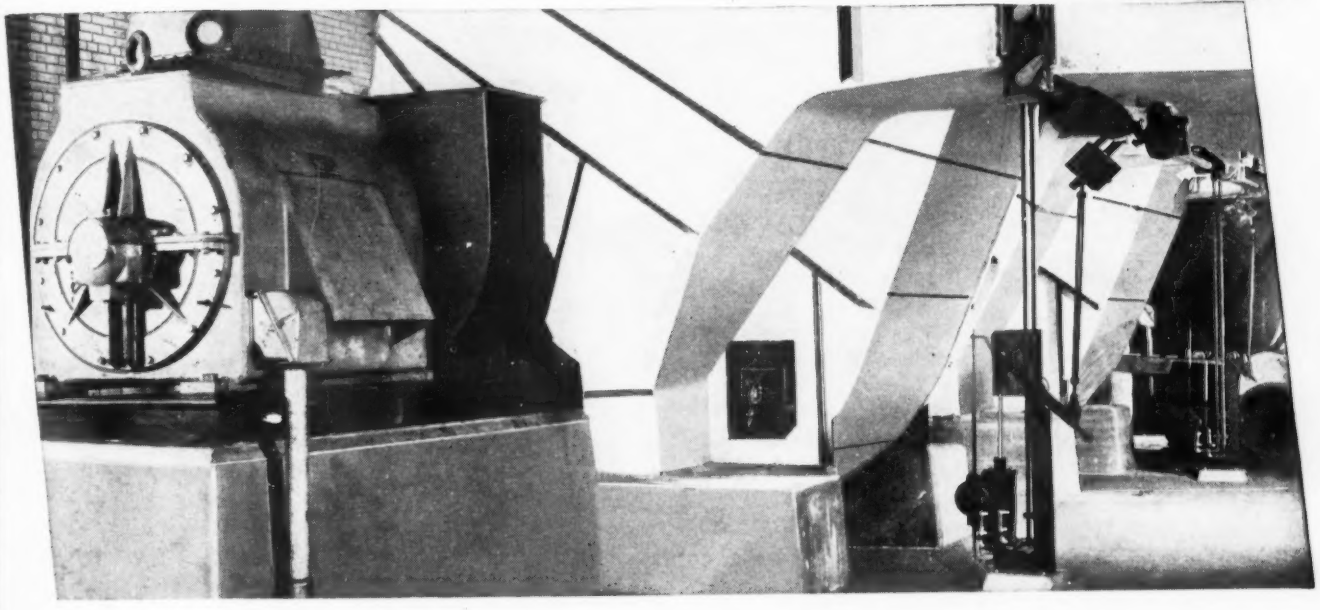
MANZEL BROTHERS COMPANY — **326 Babcock St., Buffalo, N. Y.**

QUESTION:

"Why use Variable Speed Drive on Induced Draft Fans"

ANSWER:

"For increased fan life and power saving!"



INSTALL: "Buffalo" INDUCED DRAFT FANS

. . . with Variable Speed Drive

Constant fixed fan speed—speed that is not required to carry boiler load—takes a heavy toll in maintenance expense and power costs . . . Buffalo Induced Draft Fans *with Variable Speed Drive* are the logical engineering solution to this common power plant problem. Operating at the speeds required for the load, undue wear of rotors and housings is eliminated . . . expense and delays of replacement are minimized . . . vital power is conserved. These fans are specially built for power plant installation—with extra rigid construction, vibration-free rotors, conveniently sectioned housing designs—in fact, every detail is matched to the exacting demands of 24-hour-a-day service. Complete engineering data on request.

ARMY E NAVY

BUFFALO FORGE COMPANY

488 BROADWAY *Branch Engineering Offices in Principal Cities* BUFFALO, N. Y.

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

"Buffalo" FORCED DRAFT FANS

LAST YEAR'S BONDS GOT US STARTED

THIS YEAR'S BONDS

ARE TO WIN!

★ Last year saw nearly 30,000,000 workers voluntarily buying War Bonds through some 175,000 Pay-Roll Savings Plans. And buying these War Bonds at an average rate of practically 10% of their gross pay!

This year we've got to top *all* these figures—and top them handsomely! For the swiftly accelerated purchase of War Bonds is one of the greatest services we can render to our country . . . and to our own sons . . . and our neighbors' sons. Through the mounting purchase of War Bonds we forge a more potent weapon of victory, and build stronger bulwarks for the preservation of the American way of life.

"But there's a Pay-Roll Savings Plan already running in my plant."

Sure, there is—but how long is it since *you've* done anything about it? These plans won't run without winding, any more than your watch! Check up on it today. If it doesn't show substantially more than 10% of your plant's pay-roll going into War Bonds, it needs winding!

And you're the man to wind it! Organize a vigorous drive. In just 6 days, a large airplane manufacturer increased his plant's showing from 35% of employees and 2½% of pay-roll, to 98% of employees and 12% of pay-roll. A large West Coast shipyard keeps participation jacked up to 14% of pay-roll! You can do as well, or better.

By so doing, you help your nation, you help your workers, and you also help yourself. In plant after plant, the successful working out of a Pay-Roll Savings Plan has given labor and management a common interest and a common goal. Company spirit soars. Minor misunderstandings and disputes head downward, and production swings up.

War Bonds will help us win the war, and help close the inflationary gap. And they won't stop working when victory comes! On the contrary—they will furnish a reservoir of purchasing power to help American business re-establish itself in the markets of peace. *Remember, the bond charts of today are the sales curves of tomorrow!*

You've done your bit Now do your best!

THIS SPACE IS A CONTRIBUTION TO AMERICA'S ALL-OUT WAR EFFORT BY

POWER

If your engineering library were limited to ONE book—

The 4th Edition of MARKS would give you greatest value and satisfaction as that book!

Consult Marks' Handbook for data needed in routine problems of design and practice, or in investigation of special problems or branches of work. Check your methods against best accepted practice, as reflected in its 16 big sections of carefully selected and authoritative facts. Marks' Handbook covers every branch of mechanical engineering, from aeronautics to mechanical refrigeration, from power generation to welding, from metal-cutting machines to hoisting and conveying—with a profusion of concise descriptions, fundamentals, formulas, methods, tables, diagrams, etc. Here is the means of avoiding errors, saving time and trouble in procuring vital information, assuring yourself of best results in a wide variety of problems.

MARKS'

MECHANICAL ENGINEERS' HANDBOOK

Edited by LIONEL S. MARKS

Gordon McKay Professor of Mechanical Engineering, Emeritus, Harvard University

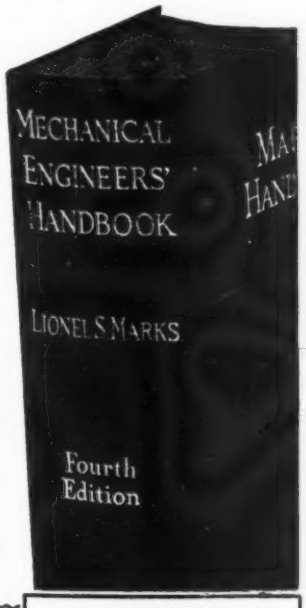
2276 pages of descriptions, data, and diagrams to aid engineers, technical men, and students in the solution of mechanical engineering problems.

The contributors number more than 100 engineers and specialists, to assure you the most authoritative and dependable information on problems of design and practice.

Largely rewritten, fully revised, chock-full of the most useful and up-to-the-minute data—a modern tool for engineers.

Priced the same as earlier editions,

$7.00



SEND THIS
On approval
Coupon
TODAY

McGraw-Hill Book Company, Inc.
330 West 42nd Street, New York, N. Y.
Send me a copy of the 4th Edition, Marks' Mechanical Engineers' Handbook for 10 days' examination on approval. Within 10 days of receipt I will send $7.00, plus few cents postage, or return book postpaid. (Postage paid on orders accompanied by remittance.)

Name .....
Address .....
City and State .....
Company .....
Position ..... P. 6-43

Do You Realize...

★ THAT 100' OF PIPE EXPANDS 5.1" DURING A TEMPERATURE CHANGE OF 0° TO 600°

★ THAT YOU *CAN'T* PREVENT IT . . .

★ THAT YOU *MUST* PROVIDE FOR IT

Unless proper provision is made for expansion caused by temperature changes, walls may be pushed out, pipes buckled—apparatus, pipes and fittings broken. With high pressure steam, this may not only be expensive but may stop production.

Eliminate these dangers by installing Adsco Expansion Joints. In addition to the Adsco Piston-Ring Joint described below, there are other Adsco joints for both high and low pressures and temperatures — internally guided — internally-externally guided — with or without drip connections, service outlets, or base.

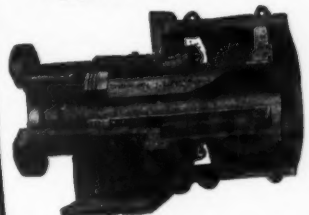
Describe your piping problem and we will be glad to make expansion joint recommendations. Write for Catalog No. 35P.

AMERICAN DISTRICT STEAM COMPANY

N. TONAWANDA, N. Y.

MAKING "UP-TO-DATE" STEAM LINE EQUIPMENT FOR OVER 60 YEARS.

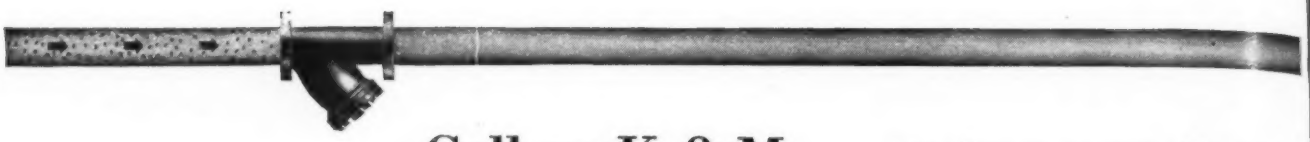
CONTROL HIGH PRESSURE, PIPE EXPANSION WITH ADSCO PISTON -RING EXPANSION JOINT . . .



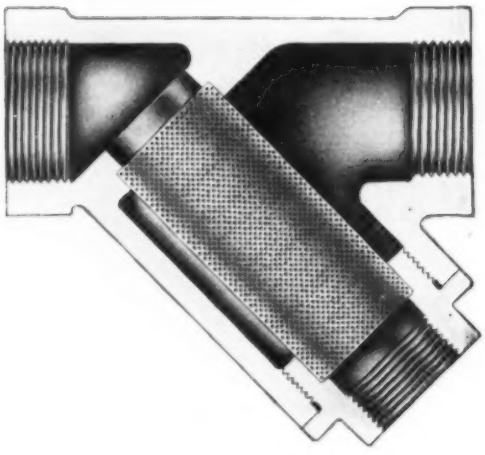
The only slip type joint that can be packed and repacked under full operating pressure. No need to shut the plant down or cut a pipe out of service.

Piston rings in the internal guide hold the line pressure during packing and repacking. Fully guided by internal and external guide. Available in single or double joints, flanged or beveled ends.

ADSCO
EXPANSION JOINTS
ELIMINATE CUMBERSOME PIPE BENDS



Call on K & M . . . *to keep your Control Equipment at Peak Efficiency!*



Our entire manufacturing output has gone to war . . . but 65 years of know-how is here to help you. If you have a pressure or fluid control problem—*any kind* of an installation, operating or maintenance problem—*call on K & M.* Our new VALVE PROBLEMS CLINIC is a clearing house of information established to keep your machinery going. There is no charge for this service. You needn't be using K & M equipment. But you have a job to do . . . and we want to *help* you do it, with specific, informative, resultful assistance.

K & M STRAINERS—"Y" and Basket Types for use on steam, water, gas, air, oil and other fluids. Note the oversized strainer basket area to assure minimum pressure loss. Baskets are easily accessible for cleaning. These features are typical of the simplicity and efficiency of K & M design.

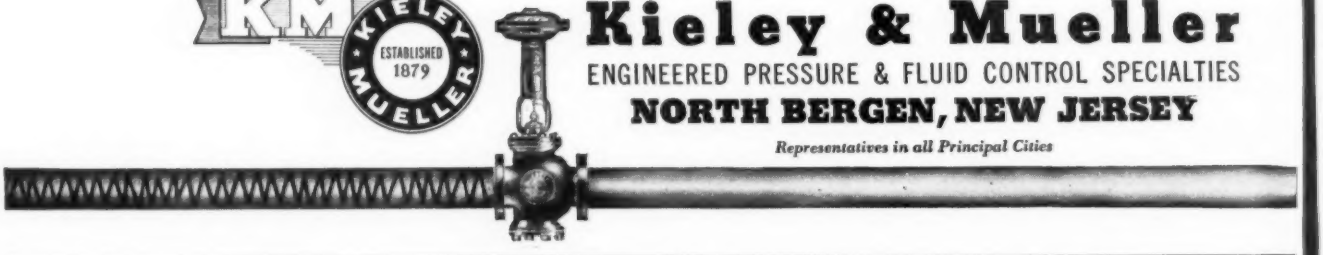
KM · KIELEY · ESTABLISHED 1879 · MUELLER

Kieley & Mueller

ENGINEERED PRESSURE & FLUID CONTROL SPECIALTIES

NORTH BERGEN, NEW JERSEY

Representatives in all Principal Cities



Why Specify S. E. Co. Coal Valves?

S.E.Co. Coal Valves open and shut with an absolute minimum of effort. Patented U-shape gate construction locates supporting rollers and operating mechanism away from contact with coal or moisture, hence—no sticking—long life—easy action. Valves are dust proof. S.E.Co. Coal Valves are used by leading central stations and industrial power plants. Write for more information about S.E.Co. Coal Valves and complete "Bunker-to-Stoker" and "Bunker-to-Pulverizer" installations. Address Stock Engineering Company, 9807 Theodore Avenue, Cleveland, Ohio.

CONICAL Non-Segregating Coal Distributors

STOCK

★ **ENGINEERING CO.** ★

S.E.Co. Coal Valves and Coal Scales

COPPER ALLOY BULLETIN

MARINE AND POWER EDITION

REPORTING NEWS AND TECHNICAL DEVELOPMENTS OF COPPER AND COPPER-BASE ALLOYS

Prepared by Bridgeport Brass Company "Bridgeport" *Headquarters for BRASS, BRONZE, and COPPER*

Basic Corrosion Studies Aid in Lengthening Condenser Tube Life

Fundamental Research Carried on at Bridgeport to Broaden Knowledge of Corrosion Causes

Research on the basic principles underlying corrosive attack has proved to be an unusually effective tool in lengthening the service life of condenser and heat exchanger tubes. The actual selection of the best tube alloy for a specific application, of course, involves far more than a knowledge of the fundamental causes of corrosion. Corrosion studies, however, provide a wealth of information on the behavior of metals and alloys when exposed to attack, and thus provide a clue to the development or improvement of alloys to give increased corrosion resistance under severe operating conditions.

Since a clear understanding of the causes of corrosion will be helpful to the marine or power engineer in recognizing the reasons for premature service failures, an outline of the mechanism of different types of corrosion will be given in this and in subsequent issues.

Electrochemical Theory

The basic phenomena of corrosion, which are the same for all metals and alloys, depend on the same principles as govern all chemical reactions—the attraction and repulsion between electrically charged particles (atoms). Examples—electro plating, storage batteries, dry cells, etc.

Water dissociates or breaks up into positively charged hydrogen ions and negatively charged hydroxyl ions:

$$(1)\quad H_2O \rightleftarrows H^+ + OH^-$$

When a metal, in the form of condenser or heat exchanger tubing, for example, is placed in water, or a water solution of an acid, base, or salt which is capable of conducting electricity, a minute quantity of metal dissolves in the solution.

This consists essentially of the metal (M) displacing the hydrogen ion (H^+) from the solution. The hydrogen (H) appears as an invisible layer of gas on the metal surface replacing the metal which dissolved:

$$(2)\quad \underset{\text{(metal)}}{M} + \underset{\text{(hydrogen ion)}}{H^+} \rightarrow \underset{\text{(gas)}}{H} + \underset{\text{(metal ion)}}{M^+}$$

The negatively charged hydroxyl ion is attracted to the positively charged metal ion, and the hydroxide of the metal is formed:

$$(3)\quad OH^- + M^+ \rightarrow MOH$$

The hydroxide may also deposit on the metal surface.

The result of these three reactions may be summed up in the following equation:

$$(4)\quad M + H_2O \rightarrow MOH + H$$

If the metal remains in the water solution long enough, the metallic hydroxide film becomes visible (for example, rust).

While equation (4) is in general applicable to all metals, there are certain important differences which have a marked influence on the corrosion process. When the more active metals, such as lithium, sodium, or potassium, are placed in water, the atomic hydrogen, instead of forming a layer on the metal surface, appears as rapidly rising bubbles of hydrogen gas:

$$(5)\quad 2H\ (\text{atomic}) \rightarrow H_2\ (\text{gas})$$

On the other hand, the less active metals, such as iron, nickel, and copper, generally produce a thin layer of hydrogen on the metal surface. This film serves as a protective coating, and if it is not removed, the corrosion process is greatly retarded or completely stopped.

However, if oxygen is present, it will react with the hydrogen to produce water:

$$(6)\quad 2H + O \rightarrow H_2O$$

and the protective film of hydrogen is thus removed. This permits the reaction in equation (4) to start again, with the consequent removal of another thin layer of metal, and the process will continue until the metal, water, or oxygen is entirely consumed.

The effect of these considerations on condenser tube selection and service can be readily seen. In the first place, it is obvious that the number of metals which can be considered for condenser tubes must be limited to those which are less reactive and permit the formation of a corrosion retarding layer of hydrogen. Since in the case of condenser tube corrosion the water cannot be completely consumed, reactions (4) and (6) will continue at a rate determined by the supply of oxygen. Hence there is a definite relationship between the oxygen content and the rate of corrosion where fresh water is the cooling medium. The presence of salts in the water introduces still other considerations.

New alloys have their beginnings in the laboratory where they are cast, processed and tested to learn their properties before they are accepted for regular production. Above is shown a miniature electric casting furnace in operation in Bridgeport's laboratory for the study of new alloys.

Note: Bridgeport products are supplied in accordance with existing priority regulations.

BRIDGEPORT BRASS

BRIDGEPORT BRASS COMPANY, BRIDGEPORT, CONN.

BRASS

ESTABLISHED 1865

BROWNELL STOKERS

For those interested in a *good* stoker for plant, institution, office building, hotel, apartment or home, there's a Brownell Underfeed to suit your requirements up to 500 h.p. with single retort—larger industrial sizes with twin retorts.

Write for illustrated bulletin

THE BROWNELL COMPANY — The World Over — SINCE 1858 — DAYTON, OHIO, U.S.A.

PROFESSIONAL SERVICES

CONSULTING CONSTRUCTION | DESIGN PLANS | EXAMINATIONS SURVEYS • REPORTS | PATENTS TRADE MARKS

ACME METER SERVICE CO.
—Utility Engineering—
Detecting wastes in Electricity, Gas, Fuel and Water, thus stopping losses, and frequently increasing production — nominal fee.
11 West 42nd Street — New York, N. Y.

HALL LABORATORIES, Inc.
R. E. HALL, Ph.D., Director
CONSULTANTS ON
BOILER WATER CONDITIONING
304 Ross St. — Pittsburgh, Pa.

JOHN A. STEVENS, Inc.
Established 1909
CONSULTING ENGINEERS
Power Plants — Paper Mills
Dye Houses — Surveys
Lowell, Massachusetts

THE BIRD-ARCHER CO.
Engineers and Consultants on Water Conditioning Problems
Surveys . . . Plant Studies . . . Analyses
400 Madison Ave. — New York, N. Y.

LANCASTER, ALLWINE & ROMMEL
Patents—Copyrights—Trade Marks
Booklets—General Information Concerning Inventions & Patents and "Free Schedule" sent without obligation.
Established 1915
Suite 456, 815—15th St., N.W., Washington, D. C.

STONE & WEBSTER ENGINEERING CORPORATION
Design and Construction
Reports • Examination • Appraisals
Consulting Engineering
BOSTON • NEW YORK • CHICAGO • HOUSTON
PITTSBURGH • SAN FRANCISCO • LOS ANGELES

COLUMBIA ENGINEERING CORP.
STRUCTURAL, MECHANICAL & ELECTRICAL ENGINEERS
War Plant Design - Supervision of Construction - Engineering Reports
61 Broadway, New York, N. Y. — 323 Plum Street, Cincinnati, Ohio

SARGENT & LUNDY
ENGINEERS
140 South Dearborn St.
CHICAGO, ILLINOIS

THE J. G. WHITE ENGINEERING CORPORATION
ENGINEERS—CONSTRUCTORS
New York, N. Y.

H. E. CORL
CONSULTING ENGINEER
Design Supervision of Construction Management
Industrial and Municipal Power Plants
Steam and Diesel
Steam and Electric Power Distribution Systems
Plant Surveys — Appraisals — Reports
1316 Arch Street — Philadelphia, Pa.

J. E. SIRRINE & COMPANY
Power Plants — *Engineers* — Consultation
Design — Reports
Water — Steam Utilization — Plans
Greenville — South Carolina

NO TIME TO EXPERIMENT . . .

So why not save time by calling in a specialist who knows the ground you are exploring?

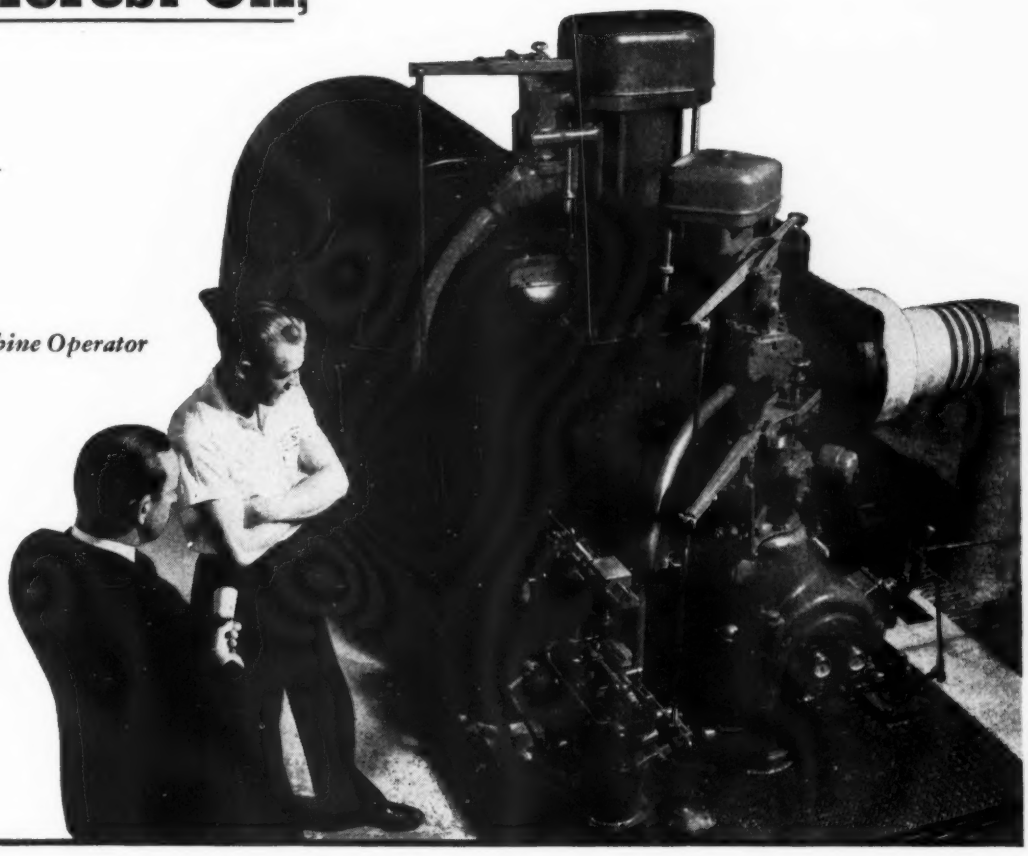
POWER, meeting place of power men in all parts of the country, points the way to the solution of many power problems through its Professional Service Section.

GILBERT ASSOCIATES, INC.
ENGINEERS AND CONSULTANTS
Power Plant Design and Construction
Rehabilitation and Maintenance
Steam — Diesel — Hydro
Reports — Examinations — Laboratory
Industrials and Utilities
61 Broadway, New York — Reading, Pa. — National Press Bldg., Washington, D. C.

STANLEY ENGINEERING COMPANY
CONSULTING ENGINEERS
Power Plants
Steam - Diesel - Hydro
Design - Construction - Test - Valuation
Central State Bank Bldg., Muscatine, Ia.

"Our annual inspection proved again the higher lubricating value of **Gulfcrest Oil**,"

says Turbine Operator



Actual plant photo of a Gulf Lubrication Service Engineer (left) consulting with Turbine Operator of the world's largest cigarette paper mill on steam turbine lubrication.

"All lubricated turbine parts — and the oil in the reservoirs — were found to be in their original condition."

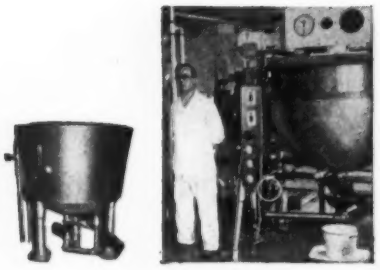
"When we recently dismantled this turbine for inspection, it showed the results of excellent lubrication," says this Turbine Operator. "All lubricated parts were found to be in their original condition, with no measurable wear. The oil in the reservoirs was also in perfect shape. This inspection proved to us again the higher lubricating value and greater stability of Gulfcrest Oil."

Here is the important reason why Gulfcrest Oil has such an outstanding record of performance in steam turbine lubrication: Gulfcrest Oil is not only refined from the best selected crude oils—it is *super*-refined by the Gulf Alchlor Process, the most effective method known for removing the undesirable constitutents present in all crudes. Thus Gulfcrest Oil has highest resistance to oxidation, acidity and sludge, and provides maximum protection to turbine bearings. Gulfcrest Oil is the world's finest oil for turbine lubrication!

Ask the Gulf Lubrication Service Engineer in your vicinity to tell you more about this unmatched turbine oil at your earliest opportunity. He will be pleased to give you complete details, without obligation.

GULF OIL CORPORATION
GULF REFINING COMPANY
GULF BUILDING, PITTSBURGH, PA.

GULF INDUSTRIAL LUBRICATION

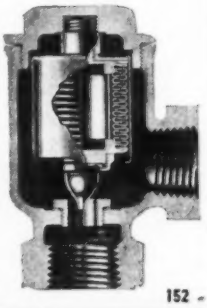


CHEMICAL AND FOOD PLANTS

all Sarco

Chrome-nickel equipment everywhere, and dozens of cookers, mixers and agitators, all equipped with Sarco No. 9 Thermostatic Steam Traps make this New York plant an outstanding example of streamlined efficiency.

The Sarco No. 9 is noted for its ability to extract all the usable heat before its wide ports open to release the condensate. It is small, low cost, works at all pressures, and is ideal for use on each coil of batteries of steam equipment in the food, process and chemical industries. Ask for Catalog No. 250.



152

SARCO SAVES STEAM

SARCO COMPANY, INC.
475 Fifth Avenue, New York, N. Y.
Sarco Canada Ltd., Federal Bldg., Toronto, Ont.

ASK for our special folder about **THIS**

Feed Water Regulator

The folder gives 17 Reasons why the

CAMPBELL

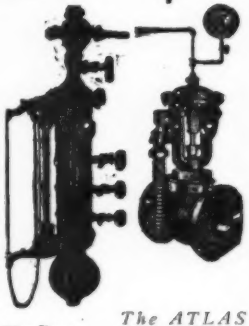
is preferred by boiler operating engineers

Here are eleven of the reasons: 1—Continuous Blowdown; 2—No Moving Parts; 3—No Thermostats; 4—No Floats; 5—No Links; 6—No Generators; 7—Instanteous Response; 8—Utmost Simplicity; 9—Lifelong Dependability; 10—High Efficiency and 11—Maximum Economy.

We can't give all of the advantages here, for instance its quick response to water level changes makes it ideal for handling abrupt load jumps.

Again, where desired, the water level can be varied through a range of 5" or 6" before fully opening or closing the feed water control valve. In other words the CAMPBELL can be made to handle your own boiler conditions most effectively.

We make regulating valves for every service. See partial list at the right. Check and mail with your name, firm name, and address.



The Regulator and Sampling Pipe

The ATLAS Control Valve, above, is easily piped to the Regulator

ATLAS VALVE COMPANY
REGULATING VALVES FOR EVERY SERVICE
289 South St., Newark, N. J.
Representatives in Principal Cities

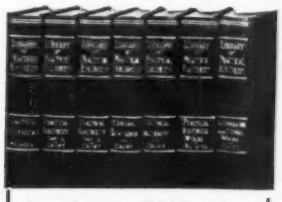
☐ Please send complete information on the Campbell Boiler Feed Water Regulator. Also please send information on the following Atlas products—

☐ Damper Regulators
☐ Temperature Regulators
☐ Reducing Valves
☐ Exhaust Control Systems
☐ Pressure Regulators
☐ Pump Governors
☐ Float Valves
☐ Oil Control Cocks
☐ Humidity Controllers
☐ Thermostats
☐ Balanced Valves
☐ Control Valves

KNOW ELECTRICITY
AS EXPERTS KNOW IT
—and get an expert's pay!

Just one new idea, one new fact, one new wrinkle, gotten from these practical books every day—and do you realize where you would be in six months or a year? Many men have backed up their experience in this way, to get in the big-pay skilled electrician class twice as fast. You can too!

The CROFT Library of PRACTICAL ELECTRICITY



7 volumes, 2906 pages 1948 how-to-do-it illustrations

• The Croft Library is a complete electrical educator. It is founded on practice—on 20 years of shirt-sleeve experience — on work as it is actually done. It is jammed from cover to cover with the kind of hardheaded facts you want. Written so that the beginner can easily understand it, yet so sound, so thorough, that it is the daily guide of 59,000 highly paid electrical workers and engineers.

A combined home-study course and reference library

• Croft tells you the things you need to know about motors, generators, armatures, commutators, transformers, circuits, switchboards, distribution systems—electrical machinery of every type—illumination in its every phase—the most improved methods of lighting—lamps and lamp effects, etc.—how to do a complete job, from planning it, to completion.

Can you answer these questions?

1. Can you locate and correct motor and generator troubles?
2. Can you lay out the wiring in your plant in accordance with the best practice?
3. Do you know enough about electric circuits to figure wire sizes, resistances, etc.?
4. Do you understand principles of alternating currents and a.c. circuits—power factor, inductance, reactance, impedance, etc.?
5. If you have to wire an old building with concealed wiring, do you know just how to go about it?
6. Do you know the National Electrical Code Rules and the reason for their adoption?
7. Do you have sufficient knowledge of mathematics to understand simple formulae, charts and graphs?
8. Do you understand the various factors or coefficients of electrical-energy-distribution systems used in central station practice, and their application in the design and operation of central stations?
9. Can you complete a job of signal wiring, such as a fire alarm system or elevator system in a large plant?
10. Do you understand the operation and applications of fluorescent bulbs?

The answers to these and hundreds of other practical problems are all in handy, understandable form in these books. Use these fact-filled pages to meet your problems, to learn the tried and tested methods of doing practical electrical work.

10 DAYS' FREE TRIAL

Fill in and mail the coupon below and we will send you the entire set of seven volumes for 10 days' examination on approval, so that you can see for yourself just how, and how much, this practical Library can help YOU.

SPECIAL LOW PRICE

Remember, the price of these books, in a special uniform library binding, saves you $1.00 on what you would pay selecting the books separately from our catalogue.

EASY PAYMENTS

In addition to the savings, you get the privilege of paying for the books in small monthly installments, while you use them. Could any offer be fairer? Take advantage of this opportunity for increasing your ability and earning power today.

NO MONEY DOWN
Just
Send this Coupon

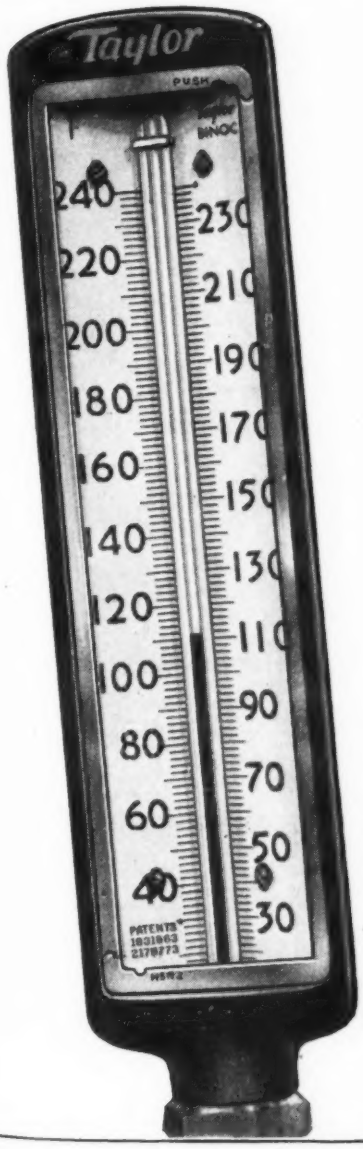
McGraw-Hill Book Co., 330 W. 42nd St., N. Y. C.

Send me the Croft Library of Practical Electricity, 7 vols., for 10 days' examination on approval. In 10 days I will send $3.00 and $3.00 monthly until $18.00 is paid, or return the books postpaid. (To insure prompt shipment, write plainly and fill in all lines.)

Name .....
Address .....
City and State .....
Position .....
Company ..... P. 6-43

HAVE YOU SEEN TAYLOR'S NEW IMPROVED INDUSTRIAL THERMOMETER?

IT'S VIBRATION PROOF - PRACTICALLY DUSTPROOF - AND EASIER TO READ THAN EVER!



IT saves tons of bronze for the war effort yet it's actually *better* in four ways than the pre-war model! Fact is, we planned it before conservation became essential.

1. New Rugged One-Piece Case. Sturdy enough to stand up under any conditions—and looks it!

2. Vibration Proof! No separate front to rattle or work loose. A two-piece interlocking bezel holds the thick glass window against four tension springs fastened with shake-proof screws.

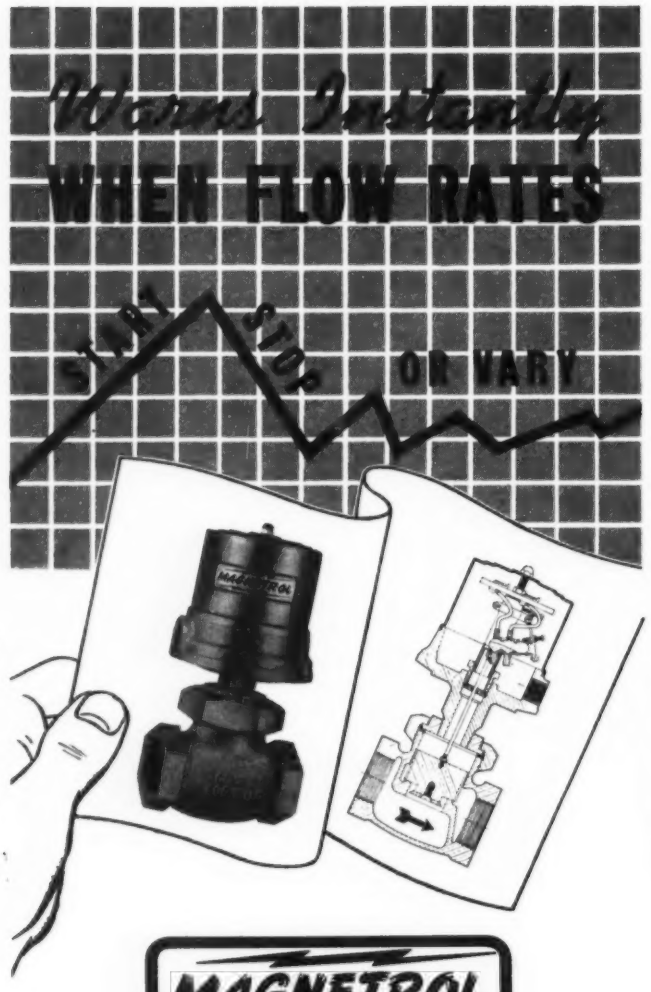
3. Practically Dustproof because of this same tight-fitting construction.

4. Easier to Read Than Ever! Actually *invites* frequent reading because the one-piece case is shallower and the triple-lens BINOC tubing stands out even more vividly, with a wider range of vision than before. Bold, well-spaced scale on sharply contrasting background is *individually graduated* for each tube!

All these advantages, plus *permanent* Taylor Accuracy—the result of artificial ageing to prevent loss of accuracy when in use—make this new Taylor Industrial Thermometer today's best buy! Ask your Taylor Field Engineer, or write Taylor Instrument Companies, Rochester, N. Y., or Toronto, Canada. *Instruments for indicating, recording, and controlling temperature, pressure, humidity, flow, and liquid level.*

Taylor Instruments
MEAN
ACCURACY FIRST
IN HOME AND INDUSTRY

★ KEEP ON BUYING U. S. WAR BONDS AND STAMPS ★



MAGNETROL
PATENTS PEND. TRADE MARK

FLOW ALARM

WRITE TODAY *for Complete Engineering Details, Charts Showing Pressure Drop Curve and Contact Opening or Closing Flow Rates for Different Sizes of Flow Alarms.*

• What do you expect of a flow alarm? Accuracy, of course—accurate operation that will signal lack or presence of flow between certain predetermined limits. Above all, you want dependability. On both points, the MAGNETROL Flow Alarm deserves your investigation.

Here is a flow alarm whose operating principle is so simple and foolproof that, once installed, it will function through thousands of cycles with little or no attention. The reason is simple: MAGNETROLS are built to operate *without* bellows, diaphragms, packing boxes, or electrodes. Switch action is based on a time-proved magnetic principle, without linkage between the moving parts of the valve and the switch. Full information on request.

SPECIFICATIONS MODEL F-500 FLOW ALARM

Maximum Operating Pressure: 200 lbs. W.S.P., 400 lbs. W.O.G. *Switch:* Mercury-to-mercury switch, furnished with either S.P.S.T. or S.P.D.T. action. *Kind of Service:* Designed for cold liquids (water, oil, etc.) but is available to operare at higher temperatures. *Sizes:* 3/4", 1", 1-1/4", 1-1/2", 2". Can be used on larger line by installing in a bypass. *Other Features:* Operates solely on rate of flow regardless of pressure. All parts made of finest quality materials.

MAGNETROL, INC.
673 N. Orleans Street, Chicago, Illinois
A Division of Fred H. Schaub Engineering Co.

Are you equipped to hold your job?—to get a new one?

The men who are keeping their jobs today—who are not feeling the whip of competition—are those who have kept one jump ahead of their jobs. They are the men who are equipped with a thorough-going and growing knowledge of the business they are in.

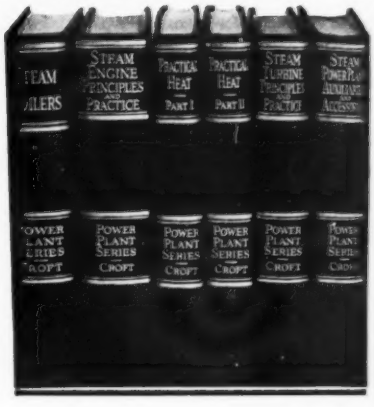
It works in the power plant field as well as in any other. Some men fit themselves to do a little more than their job calls for. They fit themselves to do a little more than the other fellow. They make a steady effort to equip themselves with the best kind of job insurance there is—KNOWLEDGE.

How about you? Do you know how quickly knowledge will pile up—how quickly you will become more valuable—if you spend a few minutes a day, regularly studying sound books like the McGraw-Hill Library of Power Plant Practice? Do you know how easily it can be managed, paying only a few cents a day, while you use the books?

Thousands of men have followed this plan to win advancement or to make their jobs safe. You can too. Read about this Library and our Free Examination Offer. Then send the attached coupon to us today.

POWER PLANT PRACTICE

(6 volumes—2,477 pages, 2,404 illustrations)


STEAM ENGINE PRINCIPLES AND PRACTICE
PRACTICAL HEAT — PART I
PRACTICAL HEAT — PART II
STEAM TURBINE PRINCIPLES AND PRACTICE
POWER PLANT SERIES CROFT

The Library of Power Plant Practice is the standard of the power plant field. It is accurate — it is thorough — it is complete. It is the result of years of experience with power plant problems. The man who has it has the best. The Library covers the whole field—nothing is omitted. The solution of every problem is plainly worded or explained with a clear illustration. The little stickers and the big troublesome problems are all worked out in advance for you. There can be only one result from studying these books a few minutes each day — more money in your pocket.

No books dealing with the work of the power plant man were ever so complete — so authoritative—so practical in text and illustrations as these. The man who puts this set of books into his library can do so knowing that he has the utmost in power plant books—a set that will give him in language he can understand, all the information he needs in order to get ahead in his work.

Easy to Understand

These books are written in everyday easy-to-understand language. They are written to help the man on the job. It is just as if the author were working in the plant by your side and giving you the benefit of his vast knowledge, man to man. There is no bunkum in this Library, nor is it cluttered up with impractical theories. It is a **Power Plant Library** FOR POWER PLANT MEN.

Glance at the titles of the books in the photograph. They will give you an idea of how completely this Library covers **Power Plant Practice.** Here you have all the information necessary to make you indispensable on the job.

See it 10 days—Send no money

Fill in and mail the coupon below and we will send you the six volumes of the Power Plant Library for 10-days' examination. If you decide to keep the books after examining them, just send $2.00 and then $2.00 a month until the total low price of $16.00 has been paid. See the coupon below for details. Send it Now and HOLD THAT JOB!

McGRAW-HILL FREE EXAMINATION COUPON

McGRAW-HILL BOOK CO., INC., 330 West 42nd St., New York

Ship to me, charges prepaid, the six volumes of the Library of **Power Plant Practice.** If satisfactory, I will send $2.00 in ten days and $2.00 a month until the price of $16.00 has been paid. If not wanted I will return the set to you postpaid. (To insure prompt shipment write plainly and fill in all lines.)

Name .....

Home Address .....

City and State .....

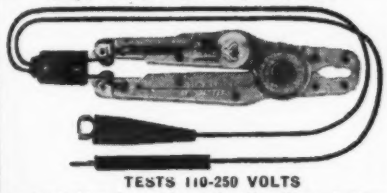
Firm or Employer .....

Position ..... P. 6-43

WHERE TO BUY

Featuring additional products and specialties for power plants

NEW DESIGN
Strong, transparent, plastic carbon test lamp, visible from any direction



TESTS 110-250 VOLTS
Insulated pliers for testing and pulling fuses. Folding prongs fit base plugs. Test cord attachable.
Can be obtained from G.E.—Westinghouse, or other first class jobbers
STAR TEST POCKET PLIERS
235 Canal St. New York, N. Y.

POWERS CONTROL
Automatic Control
For Industrial Processes, Heating and Air Conditioning Systems, Hot Water Heaters and Shower Baths. Write for Bulletins.
Offices in 47 Cities
2671 Greenview Ave., Chicago, Ill.
THE POWERS REGULATOR CO

Sometimes you'll find it here

WHEN you're in need of some product, equipment, device or service to speed production, save money, or improve products . . . you may find it here—in the Where to Buy Section.

Have you noticed these items in previous issues?

Adjustable Pipe Dies
Band Saws
Boiler Baffles
Boilers
Boiler Treatment
Chimneys
Circuit & Fuse Test Pliers
Coal Distributors
Compressed Air Dryers
Compressors
Compressor Valves
Conveyors
Furnace Wall Coatings
Gaskets
Girth Seam Protectors
Graph-Air Gun
Hand Tachometers
Industrial Thermometers
Isometric Paper
Lubricants
Mathematical Tables
Metallic Packing
Mica Undercutter
Pocket Test Pliers
Portable Welders
Power Scraper
Precision Separators
Pumps
Rapid Calculator
Refractories
Resurfacers
Steam Cocks
Steel Floats
Boiler Tube Cleaners
Valves
Waste Line Cleaners
Wrenches

It Pays to CHECK THIS PAGE —each issue.

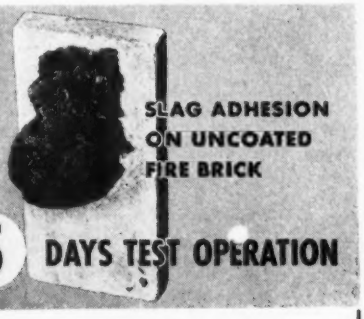
CHIMNEYS
Industrial Waste Burners
AMERICAN CHIMNEY CORP.
141 Fourth Ave.
New York City
BRANCHES: BOSTON
PHILADELPHIA · BUFFALO
CLEVELAND · DETROIT

THE ORIGINAL
Tripp Metallic Packing
TRIPP METALLIC PACKING CO.
BOSTON MASS.

USE LESS FUEL GET MORE POWER

FIRE TUBE MODEL SHOWN
VIBRATAP CLEANER
For fire tube and water tube boilers. Rapid vibration quickly breaks scale's grip on tubes. Fast, perfect cleaning—down goes fuel expense! Just try one! Also ask about our Mohawk power-driven Soot Scraper.
BRUNT EQUIPMENT CO.
60 S. DIVISION ST. BUFFALO, N. Y.

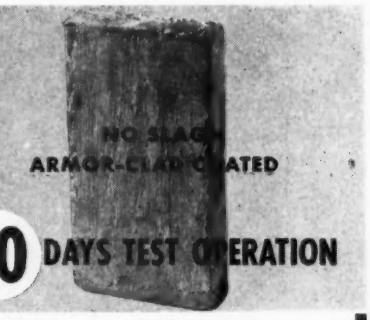
"MONO"
BOILER BAFFLES
HIGH TEMPERATURE
Refractory Cements
SANFORD C. SMITH REFRACTORIES, INC.
1715 NIAGARA ST., BUFFALO, N. Y.



Read this!
ARMOR - CLAD FURNACE COATINGS have become a nation-wide symbol of ruggedness and long-time protection to furnace walls—both boiler and *metallurgical*.

● Widely used by Army and Navy transports; Coast Guard vessels; Navy gun factories; Maritime Commission ships; and a very large number of the *most* important and largest industrial corporations in the United States.

● Hermetically seal surfaces of fire-walls—pores, joints. Prevent penetrations of flame, hot gases, vapors, dust, slag, which are the *principal causes* of fire-wall disintegration and failure. Resist slag attachments to fire-wall surfaces.



Continued—
SUCCESSFULLY USED with all types of fuel—solid and pulverized coal, gas, fuel oil, tar, hogged wood and by-products generally.

● When applied and brought to temperature by normal furnace operation, become an *inherent* and *integral* part of fire-walls, from which they *cannot* and *do not* spall.

● Low priced. Very easily applied, either by brush or spray gun. Furnaces may be fired immediately after application if desired.

Send for free samples and Bulletins: "Keep America's Furnaces on the Firing Line."
ARMOR - CLAD COMPANY
Emil A. Schroth, Pres.
39 HYATT AVE. NEWARK, N. J.

SEARCHLIGHT SECTION

EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

UNDISPLAYED RATE:

10 cents a word, minimum charge $2.00.

(See ¶ on Box Numbers.)

POSITIONS WANTED (full or part-time individual salaried employment only), ½ the above rates.

PROPOSALS, 50 cents a line an insertion.

INFORMATION:

BOX NUMBERS in care of any of our New York, Chicago or San Francisco offices count 10 words additional in undisplayed ads.

DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED—RATE PER INCH:

The advertising rate is $6.30 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page.

NEW ADVERTISEMENTS received by June 11th will appear in the July issue, subject to limitations of space available.

EMPLOYMENT SERVICE

SALARIED POSITIONS—This advertising service of 33 years' recognized standing negotiates for high salaried supervisory, technical and executive positions. Procedure will be individualized to your personal requirements and will not conflict with Manpower Commission. Retaining fee protected by refund provision. Identity covered and present position protected. Send for details. R. W. Bixby, Inc. 270 Delward Bldg., Buffalo, N. Y.

POSITION WANTED

POSITION WANTED—20 years experience as operating and chief engineer in Textile and Paper Mills. Past 45 years of age. Married. PW-536, Power, 330 W. 42nd St., New York, N. Y.

WANTED

Mechanical Engineer

Well established Midwest Pump Manufacturer offers position of Chief Engineer to man experienced in the Design of Reciprocating and Centrifugal Pumps. This position is permanent and offers an experienced man the opportunity to become part of the management in a well financed Company, which is now on war work. Please answer giving complete experience, draft status, personal history, etc. All replies will be held confidential. Address

P-543, Power
520 No. Michigan Ave., Chicago, Ill.

WANTED

DEVELOPMENT ENGINEER

For TEMPERATURE and PRESSURE REGULATORS,

Self-operated and Pilot-operated types.

Permanent position with old established Chicago firm now engaged in war work. Good salary and opportunity for advancement. Technical graduate with experience in the maintenance of control instruments in a large industrial plant would be helpful, though not necessary.

P-548, Power
520 No. Michigan Ave., Chicago, Ill.

OPERATING ENGINEERS — WANTED

Operating engineers who have or have had a Marine Engineers' License. Wages from $300 to $700 per month.

Apply

Local No. 33, M. E. B. A.
227 Fulton Street New York City

Wanted: Superintendent of Power

Essential food production industry in lower Michigan is seeking a man with experience supervising a plant of 400 lb. pressure or higher. Age 38 to 60 or draft deferred, opportunity for advancement. Send particulars regarding positions held and salaries received; include picture. All correspondence confidential.

P-545, Power
520 North Michigan Ave., Chicago, Ill.

POSITIONS WANTED

MECHANICAL ENGINEER. 24 years in boiler plants, district heating, water works, marine steam; the last six in a supervisory capacity. Experienced in plant layout, construction, operation, specifications, purchasing. PW-546, Power, 520 N. Michigan Ave., Chicago, Ill.

POWER PLANT MECHANICAL ENGINEER—25 years in Consulting Practice and Plant Operation—M. I. T. graduate—Free to travel—American—Draft exempt. PW-547, Power, 330 W. 42nd St., New York, N. Y.

POWER PLANT SUPERVISOR of operation. 17 years of experience with extremely large Westinghouse and General Electric turbines and boilers using gas oil, pulverized coal and stokers. Experienced maintenance, test work and general plant operation. Prefer location in southwest. Married, Class 3A, age 35 and best of references PW-550, Power, 520 N. Michigan Ave., Chicago, Ill.

SELLING OPPORTUNITIES

OFFERED—WANTED

Selling Agencies—Sales Executives
Salesmen—Additional Lines

OPPORTUNITY WANTED

POWER PLANT SALES ACCOUNT wanted—National sales agency, with 27 Engineering Sales Offices throughout U. S. and Canada, desires to represent an additional power plant account. F. Low Co., Inc., 16 W. 46th St., New York, N. Y.

WANTED

REPRESENTATIVES

with proven records for our fast-growing organization

Desirable Territories are also available for

DISTRIBUTORS and SALES AGENTS

WATER TREATMENT CO. OF AMERICA

1159 Hodgkiss Street, N.S. Pittsburgh, Pa.

REPRESENTATION

WANTED

Looking forward to post-war sales and service a prominent manufacturer of heavy equipment desires to discuss engineering sales representation for several territories including West Coast with headquarters in Los Angeles or San Francisco; Southwest with headquarters in Houston or Dallas, Texas; Southern with headquarters in Atlanta, Birmingham or New Orleans; Western District with headquarters in Denver or Kansas City.

Our business involves power plant equipment and heavy fabrication of chemical, oil, and processing apparatus.

Correspondence invited. Address

RW-544, Power
330 W. 42nd St., New York City

BUSINESS OPPORTUNITY

MANUFACTURING RIGHTS WANTED—Independent manufacturer with complete engineering and research staff, production facilities and international industrial sales organization wishes to develop new markets and products, particularly steam plant or allied process apparatus and in instrument and control fields. Write brief letter. BO-539, Power, 330 W. 42nd St., New York, N. Y.

FREE BULLETIN

CLASSIFIED STOCK SUMMARY 24 pages 5¼ x 8¼—indexed. Lists equipment offered for sale by several of the electric and gas utility companies of Apparatus Exchange Ebasco Services Incorporated, Two Rector Street, New York, N. Y.

MOTOR REWINDS?

ARE YOU PARTICULAR?

DO YOU HAVE A SPECIAL MOTOR?

We stock only the Best of Insulation

100% Factory Work

TRY US

Previous Experience with

General Electric Allis Chalmers
Westinghouse Navy Yard Work

C. V. HUNT

Est. 1916

Ridgefield, N. J. Morsemere 6-3011
Trucks #1—U.S. Highway and Erie Railroad

Power Plant Engineering

Turbo-generator inspection and repair, servicing Allis-Chalmers, Westinghouse, and General Electric turbines in Southern industry.

RALPH H. ROGERS & CO.

P. O. Box 707 Jackson, Mississippi

W. L. SULLIVAN

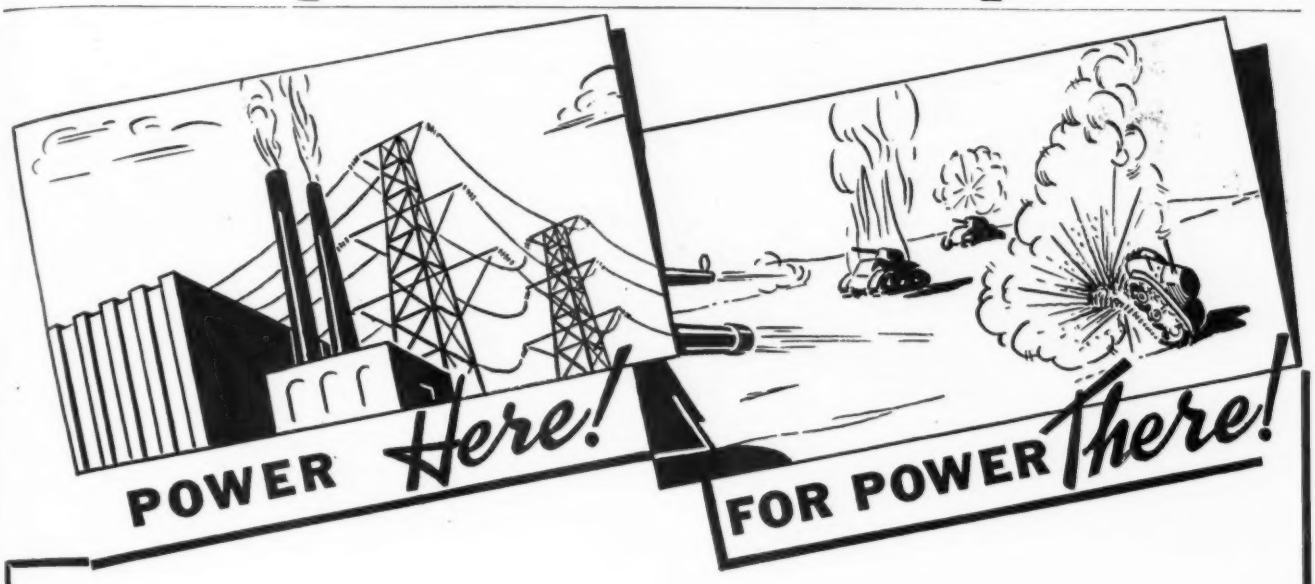
*** MECHANICAL ENGINEERING ***

Also furnishing power plants, industrial, municipal and private, plants, designed, appraised or built, complete or parts, steam or other fuels, boilers, engines, pumps, machines and manufacturing plants also, new or used equipment.

P. O. BOX 236
Oklahoma City Oklahoma

Don't forget the **Box Number**

. . . when answering the classified advertisements in this magazine. It is our only means of identifying the advertisement you are answering. *Be sure it appears on both letter and envelope.*



MOTORS GENERATOR SETS

1—5000 ampere, 6 volt, Hanson-Van Winkle
1—2000 ampere, 6 volt, Hanson-Van Winkle
1—1500 ampere, 6 volt, Hanson-Van Winkle
1—750 KW, 250 volt, Allis Chalmers synchronous
1—35 KW, 125 volt, Electric Machinery squirrel cage induction motor.
1—20 KW, 600 volt, General Electric squirrel cage induction motor.

ALTERNATORS

1—625 KVA, 3600 RPM, 600 volt, G.E.
1—250 KVA, 720 RPM, 230 volt, G.E.
1—200 KVA, 3600 RPM, 240 volt, Allis Chal.
1—62½ KVA, 3600 RPM, 220 volts, Allis Chal.

MOTORS—3 PHASE 60 CYCLE

1—400 HP, 514 RPM, 440 volt, Westg., slip ring.
1—335 HP, 600 RPM, 2300 volt, G.E., syn.
1—300 HP, 720 RPM, 2200 volt, G.E., slip ring.
1—250 HP, 514 RPM, 4000 volt, G.E., syn.
1—250 HP, 600 RPM, 4000 volt, G.E., Sync.
1—200 HP, 600 RPM, 2200 volt, G.E., sl. rg.
1—200 HP, 450 RPM, 2200/4000 v., G.E., sl. rg.
1—150 HP, 1800 RPM, 2300 volt, Al. Ch. sq. cg.
1—150 HP, 900 RPM, 440 volt, Al. Ch. sl. rg.
1—150 HP, 720 RPM, 440 volt, G.E., sl. rg.
1—150 HP, 600 RPM, 440 volt, G.E., sl. rg.
1—150 HP, 400 RPM, 440 volt, G.E., sq. cg.
2—125 HP, 720 RPM, 440 volt, G.E., sl. rg.
1—100 HP, 900 RPM, 440, Westg., sq. cg.
1—100 HP, 900 RPM, 440 volt, G.E., sl. rg.
3—100 HP, 720 RPM, 440 volt, G.E., sl. rg.
1—100 HP, 720 RPM, 440 volt, G.E., sq. cg.
1—100 HP, 600 RPM, 410 volt, G.E., sl. rg.
1—100 HP, 600 RPM, 440 volt, G.E., sq. cg.
1—100 HP, 514 RPM, 440 volt, G.E., sq. cg.

INSTRUMENTS

25—Westinghouse type U Recording Ammeters with slit core, CT.

25—Westinghouse type U Recording Voltmeters.

MOTORS—3 PHASE 60 CYCLE (Con't)

2—100 HP, 450 RPM, 440 volt, G.E., sq. cg.
1—90 HP, 400 RPM, 550 volt, Cr. Whlr., sq. cg.
1—75 HP, 900 RPM, 4000 volt, Elec. Mach. syn.
1—75 HP, 900 RPM, 220 volt, Fairbanks Morse, slip ring.
1—75 HP, 900 RPM, 440 volt, G.E., sq. cg.
1—75 HP, 720 RPM, 440 volt, Westghse., slip ring.
1—75 HP, 720 RPM, 440 volt, G.E., sq. cg.
2—75 HP, 1200 RPM, 2200 volt, G.E., Vertical.
1—50 HP, 900 RPM, 440 volt, G.E., sl. rg.
1—50 HP, 900 RPM, 440 volt, G.E., sq. cg.

MOTORS—D.C. 230 VOLTS

2—450 HP, G.E., 400 RPM, Type MPL, Form 1-F.
1—250 HP, 760 RPM, Electro Dynamic.
2—150 HP, Westghse., 550 RPM, Type SK.
1—150 HP, 750 RPM, Electro Dynamic.
1—125 HP, 600 RPM, Westinghouse, SK.
1—100 HP, G.E., 575 RPM.
1—100 HP, 625 RPM, G.E.
1—80 HP, Crocker-Wheeler, 600 RPM, Type CMC.
1—75 HP, G.E., 575 RPM, Type C, Sprague; with spare armature.
1—65 HP, 1000 RPM, G.E., Type RC.
8—50 HP, Crocker-Wheeler, 700 RPM, Type CM.
1—65 HP, G.E., 625 RPM, Type DLC-65, Form A.
1—50 HP, 750 RPM, Westghse., Type SK.
1—50 HP, 700 RPM, Crocker-Wheeler.
1—40 HP, G.E.-Sprague, 700 RPM, Type LC.
1—40 HP, 775 RPM, Westinghouse.
1—40 HP, 300 RPM, G.E.
1—30 HP, 750 RPM, G.E., type RC.
1—30 HP, G.E., 750 RPM, Type RC-14, Form A.
1—30 HP, G.E., 1100 RPM, Type RC-31B, Form A-21.
1—35 HP, G.E., 650 RPM, Type RC-15.
1—30 HP, G.E., 625 RPM, Type C.
1—25 HP, Westghse., 600 RPM, Type SK.
2—25 HP, G.E., 775 RPM, Type RC-13.
1—20 HP, G.E., 800 RPM, Type RC-12, Form A.
2—20 HP, Westghse., 1700 RPM, Type SK.
1—15 HP, G.E., 800 RPM, Type RC-11.

TRANSFORMERS

2—400 KVA, G.E., 4156-240/480 v., Scott taps.
3—300 KVA, Pittsburgh, 7800/440 volts.
3—250 KVA, G.E., 6600/2200/220/440
3—200 KVA, G.E., 2200/220/440
3—150 KVA, G.E., 33,000 2300/4000 Y.
3—100 KVA, Westinghouse, 11,430/250 volts.
1—100 KVA, Pittsburgh, 1375/2750-110/220 volts.
3—100 KVA, Westinghouse, 13200 250 volts.
3—75 KVA, G.E., 13,500-750/440 volts.
1—75 KVA, G.E., 3 phase, 4156Y—120/208Y.
3—50 KVA, Wagner, 4150-220 volts.
2—50 KVA, Pbgh. 7500/15,000 volts-110/220 volts.
4—37½ KVA, 2200-220/110 v.
7—25 KVA, Westg., air cooled, 440/220-110 volts.
1—25 KVA, G.E., 220/110-220/110 volts.
2—15 KVA, G.E., 2300-115/230 volts.

MOTORS—VARIABLE SPEED 230 VOLTS

2—100 HP, 475/1375 RPM, Electro Dynamic.
1—90 HP, 470/940 RPM, General Electric.
1—75 HP, 525/1575 RPM, Electro Dynamic.
1—60 HP, 600/1200 RPM, General Electric.
1—35 HP, 500/1500 RPM, Westinghouse.
1—35 HP, 350/1050 RPM, Electro Dynamic.
1—30 HP, 225/900 RPM, Crocker Wheeler.
7—25 HP, Westinghouse, 650/2200 RPM, Type SK-110L.
2—25 HP, 300/900 RPM, Electro Dynamic.
1—20 HP, 750/1500 RPM, General Electric.
1—15 HP, 300/1200 RPM, G.E.
1—13/18 HP, 350/1200 RPM, Electro Dynamic.
1—5 HP, 600/1200 RPM, General Electric.
1—5 HP, 450/1800 RPM, Crocker Wheeler.
1—5 HP, 400/1600 RPM, Diehl.
1—5 HP, 225/900 RPM, Electro Dynamic.

TURBO-GENERATORS

600 KW Terry dual bleeder condensing Turbine only.
1—500 KW, G.E., 3 ph., 60 cy., 480 volt, bleeder.
1—375 KVA, Westghse., non-condensing.
1—300 KW, G.E., 3 ph., 60 cy., 220 v., cond.
1—200 KW, G.E., 3 ph., 60 cy., 220 v., cond.

Hemphill FOR POWER

J. L. HEMPHILL & COMPANY

1602 53rd ST., NORTH BERGEN, N. J.

PHONE NEW YORK—LONGACRE 5-3227 NEW JERSEY—UNION 3-2600

KIEMLE OF TOLEDO, OHIO

MOTORS
GENERATORS
CONTROLS
TRANSFORMERS
MOTOR GENERATOR SETS
ETC.

BERGER OF ROCHESTER, N.Y.

Put all idle equipment to work. Send your list for prompt action.

TRANSFORMERS

4—500 KVA Gen. Elec. Type H form KDD, 60 cy. Single Phase, Primary 6900 V or 11950 Y; secondary 2300V—with taps.
3—500 KVA, GE, type H, form VD525 19100-22000/40000Y to 2300, 1 phase 25 cycle.
6—150 KVA Gen. Elec. type H 22000/220/440 25 cy. single ph.
2—75 KVA West. type S.K. 1 ph. 25 cy. 60000 volts Prim—6900/2300 volts secondary.
1—200 KVA Allis Chal. 60 cy. 3 ph., 220/440.
1—300 KVA Gen. Elec. 60 cy. 3 ph., 220/440.

ALTERNATORS

240 KW, 8 PF Electric Machinery, 4600 volts, 60 cycle 3 phase, 450 rpm with direct connected exciter.
200 KVA Gen. Elec. Ft. Wayne 3 ph., 60, 220/440, 720 RPM, revolving field.
150 KVA Gen. Elec. Type ATB form D, 60, 3 ph., 220/440 600 RPM, revolving field, built-in exciter.

D. C. GENERATORS

150 KW Western Elec. 3 brg. 3 wire, 115/230 V, 600 RPM.
50 KW Milwaukee, Comp. Wound 125 V, 600 RPM.

★400 H. P. SYNCHRONOUS MOTOR★

Complete A.C. Synchronous Motor

1—400 H.P. Wsghse Syn. motor, 3 ph, 60 cy 4000/2300 V, 400 RPM with built-in magnetic clutch. Complete panel mounted reduced voltage type Starting Control. Motor-Generator Set—factory built for excitation and clutch operation. 10 KW, 125 V, DC 1750 RPM, Type SK63, Wsghse, with direct conn. 15 HP, Type CS, 3 ph, 60 cy, 220/440 V.

300 KW Gen. Elect. Synchronous Converter, 6 Phase, type HCC form J, 25 cycle, 750 speed, 220/230 volts. With Transformers for 2300 Volts.

FREQUENCY CHANGERS

All sizes, voltages and cycles.

3 ph. 60 cy. A. C. MOTORS

H.P.	Make		Type	Speed	Volts
300	Gen. Elec.	Sl. Rg.	I Form M.	600	220/440
200	Wsghse.	Sl. Rg.	CW	600	220/440
200	Gen. Elec.	Sq. Cg.	I Form K	514	220/440
175	Ideal	Sl. Rg.	AVA	1750	2200
150	Gen. Elec.	Sq. Cg.	I K	600	2300
150	Al Ch.	Sq. C.		600	440
150	Burke	Sq. Cg.	3 BRG. 2 ph	900	220/440
125	Gen. Elec.	Sq. Cg.	I K	720	220/440

3 ph. 25 cy. MOTORS

H.P.	Make		Type	Speed	Volts
830	Elect. Mach.		Syn.	500	2300
	With Direct Connected Exciter				
200	Wsghse.	Sl. Rg.	CW	485	220/440
200	Gen. Elec.	Sl. Rg.	I Form M.	485	220/440
150	Gen. Elec.	Sl. Rg.	I Form M	500	2200
100	Wagner	Sl. Rg.	BR	750	220/440
100	Gen. Elec.	Sl. Rg.	I Form M	750	220/440
100	Gen. Elect.	Sq. C.	I K	750	220/440
100	Wsghse.	Sq. C.	CS	500	220/440
75	Wsghse.	Sq. C.	CCL	500	220/440
75	Gen. Elect.	Sl. Rg.	I M	750	220/440
75	Wagner	Sq. C.	BM	750	2200
75	Gen. Elec.	Var.	BTA	375/750	440

230V D. C. MOTORS

H.P.	Make	Type	Speed
150	Burke	Comp. Inter.	450/700
105	Gen. Elec.	CL/6 Shunt Wound	700
100	Sprague	C Interpole	600
100	Northwestern	K30 Comp. Inter.	1750
100	Wsghse.	SK143 Shunt Inter.	1750
85	Gen. Elec.	Vert. Comp. Wound	700
40	Fair. Morse	Ball BRG. Vert. Comp.	1740
32	Sturdevant	C Form P. Shunt Wound	190

MOTOR GENERATOR SET

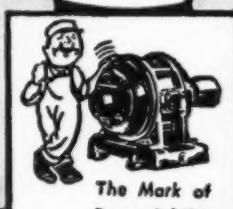
Western Elect. 1000 Amps—30 Volts direct con. to 48 P. 230 Volt D.C. 475 RPM Motor.

Only partial listing

OVER 10,000 ITEMS IN STOCK FOR IMMEDIATE DELIVERY FROM EITHER ROCHESTER, N. Y. OR TOLEDO, OHIO REBUILT AND SOLD WITH A STANDARD NEW GUARANTEE.

Write or wire your inquiries

BERGER BROTHERS ELECTRIC MOTORS, Inc.
395 STATE ST.
ROCHESTER NEW YORK



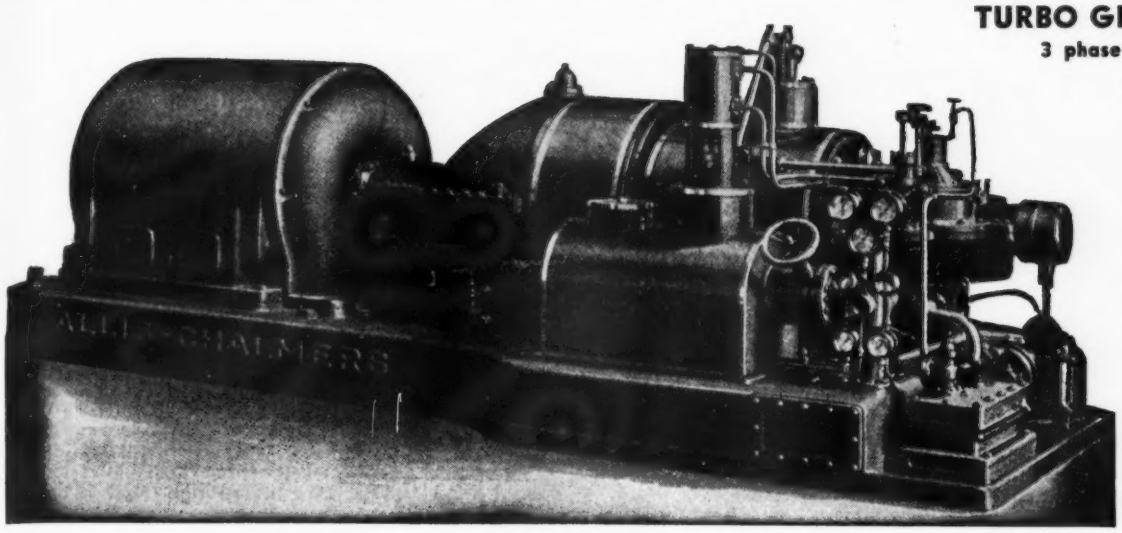
The Mark of Dependability

THE FRED W. KIEMLE CO.
33 N. SUPERIOR ST.
TOLEDO OHIO

ELECTRICAL POWER EQUIPMENT

TURBO GENERATORS

3 phase 60 cycle



Actual Photograph

1250 KVA ALLIS CHALMERS CONDENSING TURBO UNIT

1250 KVA Allis Chalmers alternating current generator 3 phase 60 cycle 2300 volts 3600 RPM direct connected to Allis Chalmers condensing turbine 150-200 lbs. steam pressure 100 deg. superheat. Equipped with jet condenser and auxiliaries.

3125 KVA GENERAL ELECTRIC 225/400 lbs. 700 deg. T.T., 2400 / 4160 volts with surface condenser

1875 KVA GENERAL ELECTRIC 160 lbs. 500 deg. T.T., 2300 volts with surface condenser

1250 KVA ALLIS CHALMERS 150/200 lbs. 500 deg. T.T., 2300 volts with jet condenser

625 KVA (2) ALLIS CHALMERS - KERR 90 lbs., 10 lbs. back pressure, 480 volts

SURFACE CONDENSER

1540 sq. ft. WORTHINGTON surface condenser with steam jet air pumps

ENGINE GENERATOR UNITS (STEAM)

3 phase 60 cycle

438 KVA GENERAL ELECTRIC-SKINNER uniflow, 150 lbs., 5 lbs. back pressure, 240/480/2300 volts

500 KVA ALLIS CHALMERS corliss, 175 lbs., 25 lbs. back pressure 240/480 volts

675 KVA GENERAL ELECTRIC-AMES uniflow, 160 lbs., 7 lbs. back pressure, 240/480 volts

ENGINE GENERATOR UNITS (DIESEL)

3 phase 60 cycle

57.7 KVA FAIRBANKS-MORSE single-cylinder full Diesel, 240 volts 300 RPM

121 KVA FAIRBANKS-MORSE 2-cylinder full Diesel, 240 volts 300 RPM

250 KVA (4) CROCKER WHEELER-WORTHINGTON 6 cylinder full Diesel, 208/120 volts 400 RPM

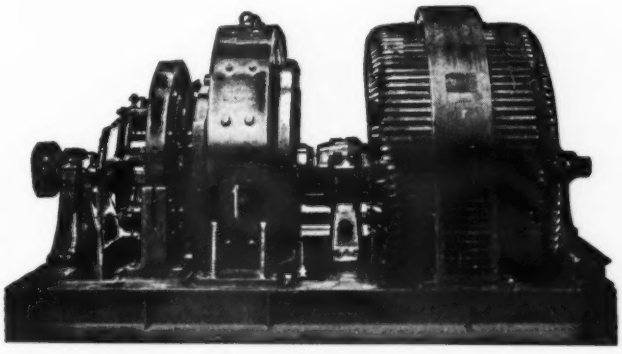
ROTARY CONVERTERS

3 phase 60 cycle

3500 KW (2) WESTINGHOUSE 225-285 volts D. C., 225 RPM, with 13200 volt transformers

1500 KW WESTINGHOUSE 225-285 volts D. C. 450 RPM, with 2300/4000-6900/12000 volt transformers

750 KW GENERAL ELECTRIC 600 volts D. C., 1200 RPM, with 2300/4000 volt transformers



Actual Photograph

1000 KW GENERAL ELECTRIC MOTOR GENERATOR SET

1000 KW (1250 KW 2 hrs. 55 deg. C rises) GENERAL ELECTRIC direct current generator 125/250 volts 3-wire 720 RPM direct connected to 1400 HP 80% P.F. (1750 HP 2 hours 55 deg. C rise) GENERAL ELECTRIC synchronous motor 3 phase 60 cycle 13200/6600 volts 720 RPM. Equipped with D.C. breakers.

MOTOR GENERATOR SETS

3 phase 60 cycle

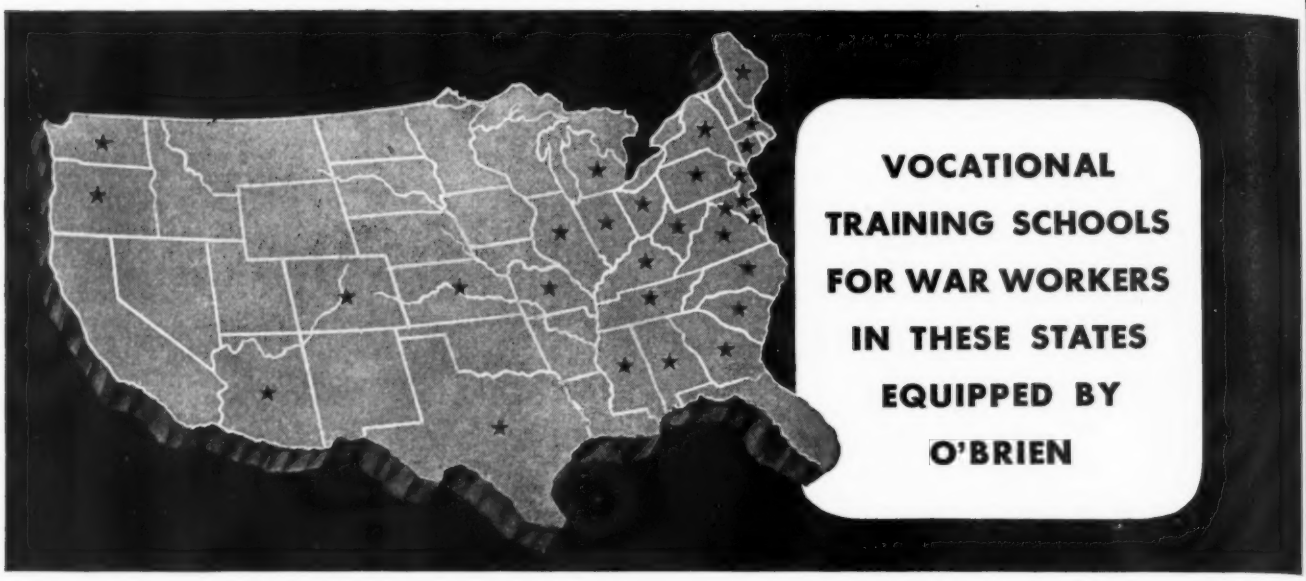
1000 KW GENERAL ELECTRIC synchronous 125/250 volts 3-wire D. C., 13200/6600 volts A. C., 720 RPM

1000 KW GENERAL ELECTRIC 3-UNIT synchronous 125/250 volts D. C., 4000/2300 volts A. C., 720 RPM

500 KW GENERAL ELECTRIC synchronous 700 volts D. C., 4150 volts A. C. 720 RPM

THE NATIONAL POWER MACHINERY CO.

1921 SCRANTON ROAD **CLEVELAND, OHIO**



IT'S a good possibility that new man who runs your boring mill was trained on an O'Brien rebuilt machine. Here's why:

In addition to a vast quantity of rebuilt machine tools and power plant equipment supplied for war contract work, O'Brien also figured decisively in the war training program. Approximately 225 schools in over half the states in the Union have turned out countless workers on O'Brien rebuilt machine tools. Many of those schools could not have started had it not been for rebuilt machinery. As responsibility for training is absorbed by industry itself, these same tools will follow into active war work.

For machine tools, power plant equipment, pumps, motors, generators, air compressors—for all your collective needs from one source, call on O'Brien.

3 ph. — ELECTRIC MOTORS — 60 cyc.

H. P.	Make	Type	Volts	Speed
250	Cr. Wh.	Syn.	440	450
150	G. E.	Sl. Rg.	440	720
150	F. M.	Sq. Cg.	440	1800
150	Al. Ch.	Sq. Cg.	2300	900
125	E. M.	Syn.	440	900
100	West.	Syn.	440	900
75	G. E.	Sq. Cg. Vert.	440	1800
75	G. E.	Sl. Rg.	440	450
75	G. E.	Sq. Cg.	440	450
75	G. E.	Sl. Rg.	440	900
60	F. M.	Syn.	220	1200
50	G. E.	Sl. Rg.	220	900
40	G. E.	Sq. Cg.	440	1200
30	West.	Sq. Cg.	220	1800
25	G. E.	Sl. Rg.	220	1200
25	G. E.	Sl. Rg.	220	900
25	G. E.	Sq. Cg.	220	3600
25	G. E.	Sq. Cg.	220	1200
20	G. E.	Sq. Cg.	220	1200

CENTRIFUGAL PUMPS — 1800 RPM

GPM	Make	Size	Head
2500	Frederick	10"	80'
1800	Worthington	8"	360'
1600	DeLaval	8"	150'
1600	Deming	6"	90'
1500	DeLaval	8"	40'
1200	DeLaval	8"	60'
1000	Deming (10 units)	5"	50'
675	Penna.	5"	346'
600	Warren	5"	460'
450	Alberger	5"	415'
400	McGowan	4"	300'
400	Worthington	4"	60'
100	Penna.	2½"	220'

ASME BOILERS

2—200 HP Coatesville HRT 78" x 20'—125#
2—250 HP Int. Eng. Wk—self-contained—200#
2—250 HP Union W.T. 160# Stokers—new, 1937
1—300 HP Erie W.T. 160# Long Drum
1—500 HP Keeler 160# Long Drum

GENERATOR SETS

3200 KW Allis-Chalmers Condensing, 3/60/2300
2500 KW G.E.-Curtis Condensing, 3/60/2300
600 KW G.E.-Skinner Uniflow, 3/60/2300
500 KW Westinghouse Turbo Non-cond. 3/60/2300
400 KW Westinghouse Turbo Non-cond., 3/60/480 (new)
325 KVA G.E.-Chuse Uniflow, 3/60/220/2300
300 KW Westinghouse Turbo Non-cond., 3/60/2300
210 KVA G.E.-Skinner Uniflow, 3/60/240
200 KW Moore Bleeder, 3/60/220
100 KW Moore Non-condensing, 2/60/220 (new 1936)
100 KW F.M. Diesel, 3/60/240 (new 1936)
50 KVA West-Harrisburg Eng., 3/60/240
35 KW Westinghouse vertical Engine, 125 D.C. volt
35 KW G.E. Turbo, 125 D.C. volt
25 KW Westinghouse Turbo, 125 D.C. volt

Everything from a Pulley to a Power House

THE O'BRIEN MACHINERY CO.

PHILADELPHIA'S LARGEST MACHINERY DEALERS AND EXPORTERS

113 NORTH THIRD STREET • PHILADELPHIA - PENNA.

BELL TELEPHONE: MARKET 4180 CABLE ADDRESS: OBRIEN-PHILA

Immediate Shipment for Quick Victory and Total Peace

under Highest War Production Board Allocation only

TURBOS—60 cycles

15000 KW capacity condensing, non-automatic bleeder (approved 275# 550° t.t.) volume extraction at either 100 or 65# g.b.p. Elspecs 60/3/standard voltage. Complete going unit including surface condenser, all auxiliaries and piping.

•

3—5000 KW 80% nominal, 7200 KVA range, 225# I.S.P. Elspecs 60/3/2300/3600. High percentage original full strength, otherwise necessary blading in stock.

•

3—2000 KW 80% nominal, 2500 KW approved range 60/3/1-440, 2-2300, condensing design and approved for non-condensing.

•

Several 300, 500, 750, 1000, 1200 and 1500 KW condensing standard pressure, also mixed pressure design.

•

TURBOS—25 cycles

50,000 KW total aggregate capacity, unit sizes of 3,000, 6,000 to 20,000 KW surface condenser equipped complete going units. High percentage full strength.

SURFACE CONDENSERS

8250, 11000, 12000, 15000 and 20000 sq. ft. surface condenser units complete. Log service on pure clear water. Condition sound.

WATER TUBE BOILERS

2—350# ASME 80,000/120,000# t.s.g. cross drum units, underfeed stoker equipped.

WATER TUBE BOILERS (Con't)

2—350# ASME 80,000/120,000# t.s.g. bent tube design, powdered fuel fired; one complete with boiler house stack, all auxiliaries, completely rebuilt and never operated.

•

4—700 HP 160,000# t.s.g. straight tube box steel header 200# ASME, without firing equipment.

•

8—400 HP 200# ASME bent tube design, superheaters, soot blowers, fans, heaters, coal and ash handling paraphernalia, etc. Also complete steel building.

•

12—200/500 HP straight and bent tube 200# units.

STOKERS

50 underfeed ram type stokers now operating in 11 retort per boiler layout under 700,000# t.s.g. units. Clinker grinders, fans and other auxiliaries available. All now under dismantling schedule.

•

1—120,000# t.s.g. powdered fuel pulverizer, burners, fans, ducts, etc. Brand new.

LARGE POWER TRANSFORMERS

50,000 KVA O.I.W.C. transformers, 150000/135000 delta—41,600/36,400; or 72,000/63,000 star.

•

9000 KVA transformers, as above.

•

15000 KVA O.I.W.C. 60,000/54,000—18,000/9000.

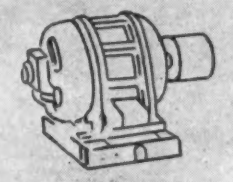
•

12000 KVA O.I.W.C. transformers, 16,000 through 12,000, 500 and 250 KVA unit sizes, 75,000/43,000—2300 and other standard voltage ratios.

Complete data available on request.

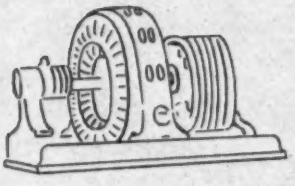
"SQUARE COOPERATION IN HEAVY POWER THRU THREE WARS"

"May we confirm the record with you, face to face?" . . .P.S.



"Single Motors Or Complete Power Plants"

Release Your Idle Power Units For Service In War Industry!

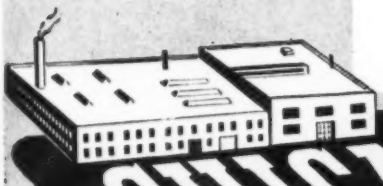


Now, the complete facilities of Chicago Electric Company are being devoted to the rebuilding of power equipment to serve war industry . . . Our contribution to the war effort is furnishing these manufacturers with equipment that's guaranteed to stand up under the toughest production schedules and deliver these units on *time*.

Thousands of manufacturers have idle, out-of-service power equipment on hand that they've overlooked—units which could be used to fill important production gaps in the plants of other manufacturers. If you are one of these, send us complete description and nameplate readings immediately. Let us rebuild it and thus help solve the power problem of one more war plant . . . Highest prices paid.

● GENERATORS	● SWITCHBOARDS	● TRANSFORMERS
● AC & DC MOTORS	● TURBO GENERATORS	● REPAIRING
● AIR COMPRESSORS	● PLATING GENERATORS	● REWINDING
● MOTOR GENERATORS	● WELDING GENERATORS	● REBUILDING

Send Complete Descriptions Of All Units Available To . . .



CHICAGO ELECTRIC CO.

INDUSTRIAL ENGINEERS

1322 W. CERMAK ROAD • CHICAGO, ILLINOIS • PHONE CAN. 2900

BELYEA OFFERS

STOCK EQUIPMENT

shipment as fast as conditions allow

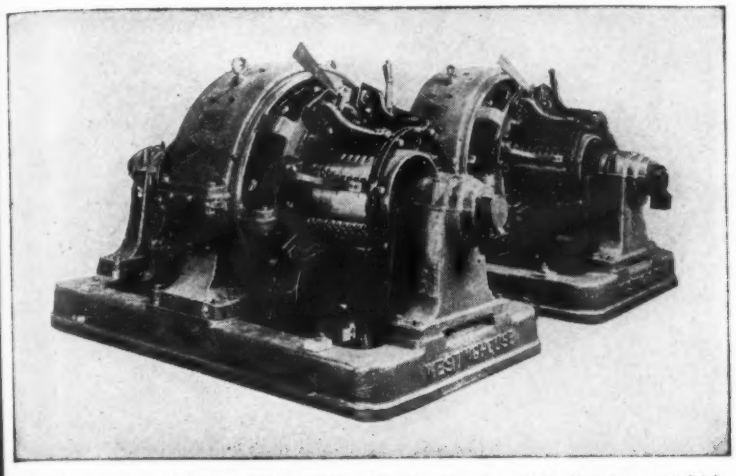


Photo above shows 2- 1000 KW, 600 volt, 60 cycle rotary converters which have been completely renovated. Once used for railway service, these units now help build ships.

ROTARY CONVERTERS

Primary 3 Phase 60 Cycle

1—1500 KW WHSE., 720 R.P.M., D.C. 600 V., A.C. 26400/13200 V.
1—1500 KW WHSE., 600 R.P.M., D.C. 600 V., A.C. 11500/10360 V.
1—1250 KW G.E., HCC, 720 R.P.M., D.C. 250 V., A.C. 2300 V.
1—1000 KW WHSE., 900 R.P.M., D.C. 600 V., A.C. 11000/23006 V.
2—750 KW WHSE., 1200 R.P.M., D.C. 600 V., A.C. 5500/2300 V.
1—750 KW WHSE., 720 R.P.M., D.C. 250 V., A.C. 6600/2200 V.
1—500 KW WHSE., 900 R.P.M., D.C. 250 V., A.C. 6600/2200 V.
1—500 KW WHSE., 1200 R.P.M., D.C. 600 V., A.C. 2300 V.
3—375 KW WHSE., 1200 R.P.M., D.C. 250 V., A.C. 6600/2200 V.
3—300 KW G.B., HCC, 1200 R.P.M., D.C. 600 V., A.C. 2300 V.

ROTARY CONVERTERS

3 Phase, 25 Cycle Booster Type

2—1500 KW G.E., HCC, 500 R.P.M., D.C. 225/275 V., 6000 Amp., A.C. 13200/6600 V.
1—500 KW G.E., HCC, 750 R.P.M., D.C. 225/275 V., 2000 Amp., A.C. 6600 V.

MOTOR GENERATOR SETS

3 Phase 60 Cycle

1—1500 KW G.E., 600 V. D.C. to 2100 H.P. 6600 V.
1—500 KW, 3 unit consisting of 2—250 KW, G.E., 250 V., d.c., to 1—700 HP, 2300 V.
1—500 KW G.E., 600 V. D.C. to 700 H.P. 13200/6600 V.
1—500 KW G.E., 600 V. D.C. to 700 H.P. 2200 V.
1—400 KW, G.E., 250/275 V., D.C. to 600 H.P. 2300 V.
2—250 KW G.E., 250 V. D.C. to 375 H.P. 2200 V.
1—150 KW G.E., 250 V. D.C. to 200 KVA, 440 V.
1—150 KW G.E., 575 V. D.C. to 225 H.P. 2300/4000 V.
1—125 KW WHSE., 250 V. D.C. to 200 H.P. sq. cg., 440 V.
1—100 KW WHSE., 250 V. D.C. to 159 KVA, 2300 V.
1—100 KW WHSE., 250 V. D.C. to 175 H.P. sl. rg. 2200 V.
1—75 KW G.E., 125 V. D.C. to 120 H.P., sq. cg., 2300/4000 V.
2—50 KW G.E., CD, 125 V. D.C. to 75 H.P., sq. cg., 2300/4000 V.
1—40 KW WHSE., 230 V. D.C. to 45 KVA 2300 V.

TURBO GENERATOR SETS

1—500 KW Whse., 625 Kva. 440 V. 3 ph. 60 cy. 3600 RPM with Parsons 145/175 lb. cond. turbine complete with jet cond. and access.
1—500 KW G.E. 625 Kva 2300 V. 3 ph. 60 cy. with Curtis 4-stage 150 lb. cond. turbine with cond. and access.
1—75 KW Ridgeway 250 V. D.C. with Terry turbine 180 lb. pressure with 12 lb. bk. pres., 2000 RPM.

GEAR REDUCTION UNITS

1—2100 H.P. Whse. 1800/360 RPM.
1— 943 H.P. G.E. 5306/1200 RPM.
1— 750 H.P. Al. Ch. 3600/600 RPM.
1— 450 H.P. G.E. 3600/1200 RPM.

A. C. MOTORS

3 Phase—60 Cycle

SLIP RING

P	Make	Type	Volts	Speed
2—1200	Cr. Wh.	801Q	2300	237
1— 800	Al. Ch.	ANY	440	885
1— 600	G.E.	IM	2200	900
1— 450	Whse.	HW	2200	875
1— 400	Al. Ch.	ANY	440	1200
1— 400	G.E.	MT	550/440	300
1— 400	Al. Ch.	ANY	2300	505
1— 350	G.E.	MT-442	2300/4000	257
1— 300	G.E.	IM	440	720
1— 250	G.E.	MT	4000/2300	257
1— 250	G.E.	MT-410	2300	390
2— 200	G.E.	IE-M	2200	1750
2— 200	Whse.	CW	2200	514
1— 200	G.E.	I-M	440	600
2— 175	G.E.	IE-M	2200	880
1— 150	G.E.	IM	2200	695
1— 150	Whse.	CW	220	1165

A. C. MOTORS

SQUIRREL CAGE

HP	Make	Type	Volts	Speed
1—500	G.E.	I-17B	2200	690
1—400	Whse.	CS-1104A	2200	585
1—300	Whse.	CS	550	580
1—300	G.E.	IK	440/2300	600
1—250	Al. Ch.		220/440	1150
2—200	Whse.	CS	2300	1200
1—200	G.E.	IK	2200	490
1—200	Whse.	CS	4600	900
—150	Al. Ch.	AN	440	1765
1—100	Whse.	CS	550	1750

A. C. GENERATORS AND SYNC. MOTORS

3 Phase—60 Cycle

KVA	Make	Type	Volts	Speed
1—625	Whse.		480	900
1—500	G.E.	TS	440	360
1—250	G.E.	ATB	2300	600
1—250	G.E.	ATI	220	450
1—225	G.E.	ATB	220	600
1—150	Whse.		2400	900
1—150	Whse.		4000	1800
1—100	Whse.		2400	900
2—100	Whse.		2300	1800
1— 45	Whse.		2300	514

TRANSFORMERS

60 Cycle

KVA	Make	Ph.	Type	Voltages
3—1000	G.E.	1	HKDD	13200x2300
3—1000	Pitts.	1	OISC	2300/4600x575
4— 525	G.E.	1	HJ-DD	2300x445
3— 400	Whse.	1	S	2400x440
2— 333	Whse.	1	OISC	2300x460
2— 333	Pitts.	1	OISC	2400x220
3— 300	Pitts.	1	OISC	2300x115/230
3— 300	G.E.	1	H	13200x2300/575
2— 200	G.E.	1	HILD	26400x115/460
3— 200	G.E.	1	H-KDD	13800x220/440
3— 150	Whse.	1	SK	2200x440/220
3— 150	Whse.	1	SKM	2400x120/240
6— 100	Whse.	1	SK	6900x460/230
3— 100	Whse.	1	OISC	13200x250
3— 100	G.E.	1	HK	2200x440

D. C. MOTORS

HP	Make	Type	Volts	Speed
1—2000	Whse.	Mill	600	300/500
1—1500	Whse.		550	330
2—1250	G.E.	MPC	500	130
1— 800	G.E.	MPC	550	600
2— 625	G.E.	MPC	250	130
2— 600	G.E.	MPC	550	600/800
1— 600	Whse.		230	150/275
1— 350	G.E.	MPC	230	450
1— 300	G.E.	MCF	230	400/1000
6— 300	G.E.	DMC	230	400/600
1— 300	Cr. Wh.	CMC 102H	230	1150
2— 300	Whse.		500	250/400
1— 300	G.E.	MPC	230	275/550
1— 300	G.E.	MPC	230	250/440
2— 200	Whse.		230	400/500
1— 175	Whse.	SK	250	150/525
7— 150	G.E.	RC-19	230	800/1000
2— 150	Whse.	SK	230	300/900
2— 125	G.E.	CO-1832	230	625
2— 120	Whse.	SK	230	720
1— 100	Al. Ch.		230	950/1150
3— 100	G.E.	LC	230	1200
1— 100	G.E.	MPC	230	225/450
1— 100	Whse.	SK	230	600
2— 100	G.E.	RC-19	230	575-720
1— 75	G.E.	C	230	500/1000
4— 60	Diehl	K-11	230	500/1000
3— 60	Cr. Wh.	CMC-65H	230	500/1000
4— 50	G.E.	RC-16	230	650/815
1— 50	Cr. Wh.	CMC-81H	230	300/900
1— 50	Cr. Wh.	CMC-80H	230	380/750
1— 50	G.E.	RC	230	400/1200

RE-NU-BILT BELYEA MOTORS

SUCCESSFUL OPERATION GUARANTEED

BELYEA COMPANY INC.

Main Office & Shop: 43 HOWELL ST., JERSEY CITY, N. J.

COMPLETE POWER PLANT

Inspection at place of present operation, Rochester, N. Y.

BOILER PLANT

new 1934

3—150 HP. Wickes, H.R.T. Steam Boilers 150 lb. pressure, Excellent condition, ASME code

1—Preheating boiler

STOKERS

3—Combustion Engineering Stokers, type E-ED, underfeed, draft fans and automatic blower control. Motor, 3 ph. 60 cy. 220 volt.

ASH CONVEYOR

1—Brady Steam ash conveyor and ash silo, including piping.

1—Overhead coal handling system (including rails, hopper and lift)

FEED WATER HEATER

1—Cochrane metering feed water heater

PUMPS

2—Duplex boiler feed pumps 10 x 6 x 12

MISCELLANEOUS

1—Blow down tank including piping and double valves. Hayes CO 2 recording instrument; all boiler header piping, double safety valves, shut-off valves, automatic stop valves and other piping connected to boiler.

STEAM COMPRESSORS

1—500 cu. ft. Ingersoll-Rand type 10, air compressor Ser. No. 25702 PP-RH, 25701 PP-LH

1—1000 cu. ft. Ingersoll-Rand type 10, air compressor Serial No. 37489 PP, 37490 PP

POWER PLANT

ENGINE GENERATORS

1—COOPER CORLISS engine, 140 lb. pressure, 28" bore x 42" stroke, 100 RPM. direct connected to 625 KVA, Gen. Elec. alternator, 3 ph. 60 cy. 240 volt .8 Power Factor, 100 RPM.

1—COOPER CORLISS engine, 140 lb. pressure, 22" bore, x 36" stroke, 110 RPM. direct connected to 250 KW. Crocker-Wheeler DC generator, type CCD, 250 volt with balancer set.

MOTOR GENERATORS

200 KW. Gen. Elec. motor gen. set, synchronous motor, 3 ph. 60 cy. 220 volt, 300 HP connected to Gen. Elec. generator, 220 v. 1200 RPM., AC and DC control

100 KW. Gen. Elec. motor gen. set, synchronous motor, 3 ph. 60 cy. 220 v. 150 HP connected to Gen. Elec. generator, 220 v. 1200 RPM., AC and DC control

SPECIAL

1—1000 KW. Westinghouse, type SK, 250 volt engine generator, Penn Harris Cross compound, 90 RPM. engine. Located Tennessee. Inspection by appointment.

NOTE: All equipment sold subject to government regulations and prior sale.

TRANSFORMERS—SAFETY SWITCHES—CAPACITORS—METERS—PANELBOARDS—COMPENSATORS. REMEMBER—SOME OTHER PLANT CAN USE THE EQUIPMENT YOU DON'T NEED. SEND US YOUR LISTS—WE WILL BUY FOR CASH AND RE-SELL TO DEFENSE PLANTS.

ELECTRIC EQUIPMENT CO.

680 LAKE AVE. PHONE: Glenwood 6783 ROCHESTER, N. Y.

REBUILT POWER EQUIPMENT

READY TO SHIP!

ROTARY CONVERTERS

1—200 kw. G. E. 275 v. 900 rpm., 6 ph. 60 cy. complete with overspeed device and transformers.
1—500 kw. G.E. type HC-8 600 volt, 900 rpm., 6 ph., 60 cy. pedestal bearing with overspeed device complete with transformers.

MOTOR GENERATOR SETS

150 KW Ridgway 250 v. D.C. 900 rpm. dir. con. 2300/3/60 syn. motor, complete.

ENGINE GENERATOR SETS

225 kw. Elec. Machy. 2200 or 220 v. 2 ph. 60 cy. dir. con. Ideal Steam.
1—225 kw. Elec. Machy. 2200/220 or 440 v. 3 ph. 60 cy., 200 rpm., dir. con. Ideal Engine 4 valve non-releasing.

100 HP. LIGERWOOD HOIST

Double drum Speedwell 2500 lb. pull at 450' per min. direct driven by 100 hp. A.C. or D.C. Motor.

A.C. GENERATORS

219 kva. G.E. 2300/3/60 200 rpm. 80% P.F. (Can be reconnected 440 or 220 v.)
1—250 KW, 480 V., 3/60, Allis-Chalmers, 150 rpm.

D.C. GENERATORS

1—750 KW, 250 B. D.C., 115 rpm., West.

A.C. MOTORS—3 ph. 60 cy.

Qu	H.P.	Make	Volts	Speed	Type
18	1/3	G. E.	220	900	K
33	1/2	G. E.	220	1140	K
19	1½	Ilg. (Totally enclosed)	220	490	ball bearing
18	2	Ilg.	220	600	ball bearing
5	5	G. E.	220	900	KT-751
6	10	American (Enclosed — ball bearing)	440	1200	PK
1	10	Allis Chal.	220	1200	
1	10	G. E.	220	1200	K-326
1	10	G. E.	220	900	KT-502
1	10	Allis Chal.	440	575	
1	10	American (Enclosed-ball bearing)	440	570	PK
3	10	G. E.	440	570	KT-322
11	10	G. E.	440	495	KT-332
9	15	Allis Chal.	440	1500	AN
1	15	G. E.	440	1800	I-10
1	15	G. E.	220	1200	KT-954
1	15	Burke	220	1200	EM1.2
1	15	G. E.	440	1200	FTR-502
		(High torque — low starting current — across the line start)			
1	15	Triumph	220	1150	
1	15	G. E.	440	900	I-K
1	15	G. E.	440	900	KT-322
2	15/30	West. (Two speed induction Motor)	220	550/1100	MS
1	15	Allis Chal.	440	860	ball bearing
1	15	G. E.	440	865	
1	15	West.	440	860	CS
2	15	Triumph	440	850	ball bearing
3	15	G. E.	440	690	KT
3	15	G. E.	440	575	KT-326
8	15	G. E.	220	570	KT-332
2	15	West.	220	550	MS
1	15	West.	440	450	CS
1	15/45	West.	440	450/850	CS
9	20	Allis Chal.	440	1800	AN
1	20	West.	220	1750	
1	20	Reliance	440	1200	
10	20	American (Enclosed — ball bearing)	440	1200	PK
1	20	G. E.	440	1200	KT
1	20	G. E.	440	875	
1	20	G. E.	220	900	KT-522
1	20	Triumph (High torque)	220	900	TR10-S
1	20	G. E.	220	900	I
1	20	Allis Chal.	440	720	
9	20	G. E.	440	690	KT-332
1	20	G. E.	220	680	KT-322
1	20	West.	440	680	
1	25	Crocker Wh.	220	1150	118-Q
2	25	G. E.	220	900	KT-326
1	25	Crocker Wh.	220	900	
1	25	G. E.	220	900	KT-332
2	25	West.	220	720	CS
1	30	Allis Chal.	440	1800	
1	30	G. E.	440	1200	KT-332
2	30	West.	220	1100	MS
1	30	Triumph	220	900	B-125
1	30	Allis Chal.	220	900	
1	30	Allis. Chal.	220	900	NR
1	30	Triumph	220	525	TR-138
1	35	G. E.	440	1200	I
1	35	Lincoln	220	720	
1	35	G. E.	440	600	KT
2	35	West.	220	514	CS
1	30/36	G. E.	220	3600	KT-205y
2	35	G. E.	550	900	I-8
1	35	Crocker Wh.	220	570	122Q
1	40	Allis. Chal.	220	900	
1	40	Century (Automatic Start)	440	900	AS-40
1	40	G. E.	220	720	KT-346

A.C. MOTORS—3 ph. 60 cy.—cont.

No.	H.P.	Make	Volts	RPM.	Type
1	40	Am. Elec. (Vertical ball bearing)	440	685	
2	40	Am. Elec. (Enclosed ball bearing)	440	685	PK
1	40	West.	220	600	CS
1	45	West.	440	850	CS
1	50	U. S. Elec. (Vertical — ball bearing — automatic start)	440	3600	STUS
7	50	Allis Chal.	440	1800	AN
2	50	West.	440	1800	C
1	50	G. E.	440	1800	KT
1	50	G. E.	220	1200	KT-343
1	50	Crocker Wh.	220	1160	
1	50	West.	440	1120	C
1	50	G. E.	440	900	KT-342
1	50	G. E.	440	900	I-8
2	50	West. Elec.	440	870	
3	50	Wagner	440	850	
1	50	West.	440	850	CCL
1	50	West.	440	650	CCL
2	50	West.	220	600	CS-752C
1	50/100	West.	440	345/700	CS
1	54	Allis Chal.	440	900	
6	60	Allis Chal.	440	1800	AN
1	60	G. E.	440	1800	KT
1	60	West.	440	1800	C
1	60	G. E.	220	720	I-8
1	60	Crocker Wh.	220	670	122Q
1	60	Triumph	220	430	
1	65	West.	440	1800	M
6	65	Allis Chal.	440	1800	AN
3	65	G. E.	440	1800	KT-347
2	75	Louis Allis (Adjusto speed clutch motors — normal torque — low starting current, ball bearing, nema frames)	440	450/1725	DV-505y
1	75	G. E. (Ball bearing, drip proof — normal torque low starting current)	440	1180	FT-542
1	75	G. E.	220	900	I-8
1	75	G. E.	440/550	720	I-10
1	75	West.	220	600	CS
1	75	Crocker Wh.	220	514	124Q
3	100	G. E.	440	1800	KT-547
1	100	G. E. (Ball bearing, Drip Proof — Norma Torque — Low Starting Current.)	440	1800	FT-542S
1	100	West.	220	1750	
1	100	G. E.	220	1200	I-8
1	100	Allis Chal.	440	900	
1	100	G. E.	440	720	I-K-14
1	100	Allis Chal.	220	600	
1	100	Crocker Wh.	220	575	124QB
1	100	G. E.	440	400	I-K
1	100	G E.	440	200	syn
1	125	Wagner	440	1800	
1	125	G. E.	440	1800	I
1	125	Allis Chal.	440	1800	AN
1	125	Crocker Wh.	220	720	124QB
1	125	Allis Chal.	440	695	
2	125	G. E.	550	514	I-K
1	125	G. E.	440	450	I-K
1	125	G. E.	220	400	I-K
1	125	G. E.	550	400	I-K
1	150	Allis Chal.	2200	1800	AR
1	150	Wagner	440	1800	
1	150	G. E.	440	1800	I-4
1	150	Allis Chal.	440	1800	AN
2	150	G. E.	440	900	I-K
2	150	G. E.	440	600	I-K
1	150	G. E.	550	575	I-K
2	150	G. E.	550	514	I-K
1	150	G. E.	440	514	I-K
1	150	G. E.	220	450	I-K
1	150	G. E.	550	450	I-K
1	150	G. E.	2200 220/400	450/243	
1	150	West.	2200	327	syn
2	150	G. E.	440	200	syn.
1	200	G. E.	2200	1800	KT
1	200	G. E.	2200	1200	I-K
1	200	West.	2200	900	CS-967A
2	200	G. E.	550	720	I-K
1	200	West.	220	580	CS
2	200	G. E.	220	600	I-K
2	200	G. E.	550	600	I-K
1	200	G. E.	550	514	I-K
1	200	G. E.	220	514	I-K
4	200	Allis Chal.	2300	347	AN
1	225	G. E.	2200	200	syn.
1	250	G. E.	550	720	I.K.
4	250	Allis Chal.	2300	435	AN
1	260	West.	2200	450	Syn.
4	400	West.	2200/220/440	500	CS
1	1000	G. E.	2300	509	K

SLIPRING MOTORS—3 ph. 60 cy.

No.	HP	Make	Type	Volts	RPM
1	1500	Westg.	CW	2200	435
1	700	G.E.	MT-43?	2200	393
1	400	Westg.	CW	440/220	1170
1	300	Westg.	CW-1106	2200	580
1	300	W. El.	I-12	440/220	600
1	250	Westg.	CW	2200	345
2	250	G.E.	I	550	600
1	100	G.E.	I	220	450
1	100	Westg.	CI	220/440	1750
1	75	Cr.Wh.		220/440	875
1	60	Tr'ph	C-16	220/440	430
1	60	Westg.	HF	2200	690
1	53	G.E.	I	220/550	1165

SLIPRING MOTORS—3 ph. 60 cy.—con.

No.	HP	Make	Type	Volts	RPM
1	52	G.E.	ITC5012	220/440	900
1	50	G.E.	MT556	440/220	430
1	50	Westg.	HF	440/220	860
1	50	Al.Ch.		440/220	900
2	50	Westg.	HF	220/440	1120
2	50	Westg.	CW636A	440/220	1150
2	40	G.E.	MT	220/440	1155
1	40	G.E.	I	440/220	1200
1	25	Westg.	MW	220/440	680
1	25	G.E.	I	440/220	670
1	25	Westg.	CI	220/440	900

D.C. MOTOR

1—800 HP, West., 650 V. D.C., 370 rpm.

TRANSFORMERS—1 ph. 60 cy.

3—1500 Kva. Pittsburgh Transformers, 22,000 volt Primary, 6900/6600/2200 volt secondary.

No.	Kva.	Pri.	Sec.	Make	Ph.
1	250	2300	460	G.E.	
3	150	22000	6900	Fgh.	
1	150	2200	230/460	G.E.	3 ph.
1	100	2200	110/220	G.E.	
3	100	6600	550/440/220	Fgh.	
2	75	2200	220	Burke	3 ph.
2	50	2300	220/440	G.E.	
3	50	11430/6600	550	Al. Ch.	
3	50	6600	575	G.E.	
1	37½	2300	220/440	Wagner	
3	37	4400	185	West. (Rotary)	
1	30	2200	110/220	G.E.	
2	30	440	220/110	West.	
25	25	2200	122/244	G.E.	
3	15	2200	122/244	G.E.	
35	10	2200	122/244	G.E.	
40	10	2200	122/244	West.	
100	7½	2200	122/244	G.E.	
50	7½	2200	122/244	West.	
50	5	2200	122/244	G.E.	
75	5	2200	122/244	West.	

SERIES MOTORS

Qu.	HP	Make	Type	RPM	Volts
1	175	G.E.	MD-109½	475	230
1	50	Westg.	K-10	435	500
1	15	Cr.Wh.	SM-58	270	230
1	10	Westg.	"	1100	500
1	10	G.E.	CQ	650	230
3	10	G.E.	CO-2504	700	110
3	7½	Cr.Wh.	AW	800	230
1	5	Imp.		540	250
3	3½	Westg.		600	250
6	2	Reliance	HZ	850	230
2	1	Westg.	CD-923	900	230

VARIABLE SPEED MOTORS—230 V. D.C.

No.	Hp.	Make	Type	RPM
1	200	West.	SK-	400/800
1	100	G. E.	rc-39	600/720
1	35	West.	sk-140	675/1350
1	30	West.	sk-123	850/1700
1	30	G. E.	rlc-	450/900
1	20	West.	sk-120	700/1400
4	20	West.	sk-110L	750/1500
2	10	G. E.	le	625/1250
1	5	G. E.	CD-85	450/1800
2	3	Jantz Liest	BI	650/1950
3	2½	G. E.		500/1000
1	2	West.	SK-63	300/1800
1	2	West.	SK-23	700/2100
1	½	Northern		700/2100

25-30 cy. MOTORS 220/440 V. A.C.

Qu.	HP	Make	Type	RPM
1	75	G.E.	I-4	900
1	75	G.E.	KT-357	900
1	75	Allis-Chalmers	AN	900
3	50	G.E.	KT-547	900
3	40	G.E.	KT-347	900
6	40	Allis-Chalmers	AN	900
1	35	Western Elec.	8L13B	500
1	35	West.	M	900
1	30	West.	C	720
1	30	G.E.	KT	900
7	30	Allis-Chalmers	AN	900
2	25	West.	MS	715
9	10	Allis-Chalmers	AN	900
1	10	G.E.	1-4-10	900
1	5	G.E.	MT	695
1	3	West.	CS	1450
1	3	Western Elec.	CL7 BA	1500
2	2	G.E.	K	1410
1	2	West.	CS	710
1	2	Hawthorne	CL7 AA	750
1	2	West.	CS	695
1	1	West.	CSA	750
1	½	Century		1460

DIESEL ENGINE GENERATOR SET

217 KVA G.E. 2300/3/60 dir. con. 260 HP Buckeye 2 cyl. 200 rpm. semi-diesel engine, complete.

WRITE, WIRE OR PHONE YOUR ELECTRICAL REQUIREMENTS

DUQUESNE ELECTRIC & MFG. CO.

PITTSBURGH, PA.

SEARCHLIGHT SECTION

SPECIALS

3—1600 Amp. Gen. Elec. 20 to 60 Volt D.C. Generators, type MPC 1150 RPM

2—300 HP Gen. Elec. 230 V. D.C. Motors type MPC.

4—1600/800 amp. Westinghouse 30/60 Volt D.C. Generators 600 RPM

230 Volt D. C. Motors

PARTIAL LISTING

H.P.	Make	Type	Speed
300	G.E.	MPC	1150
150	West.		600
85	G.E.	TRC37	880
60	Roth		600
50	Cr. Wh.	CMC	700(2)
50	G.E.	CL50	560
50	G.E.	RC15	850
46	Diehl	K10	850/1020
40	G.E.	CL6	975
35	West.	Sk120	1150
35	G.E.	RLC204	440/800
30	West.	S6	1025
30	West.	Sk120	975
30	West.	SA	500/1500(3)
26	Diehl	K8	850/1020
25	Eck.		1150
25	Rel.	92T	1150
25	West.	Sk11OL	1100
25	G.E.	RC31	1150
25	All. Ch.	E100	1150
25	G.E.	CD93	1150
25	G.E.	DLC202	700
25	G.E.	CD113	575
25	Rel.	310T	300/1200
20	West.	Sk83	1750(2)
20	Cr. Wh.	CM	1750
20	G.E.	CD	1750
20	G.E.	CD83	1200/1600
20	R. & M.		1160
20	G.E.	RC30	1150(2)
20	G.E.	CD85	1150
20	West.	SK103	1150
20	G.E.	RC31	1150
20	West.	Sk93	1150
20	G.E.	RC11	1150
20	West.	S6	975
20	G.E.	RC12	800(2)
20	West.	Sk11OL	750
20	A.-C.	Ser.	625
20	Rel.	T	400/1600
19	West.	S	1300(2)
17½	Sprague	D	1750
15	G.E.	RC2980	1700
15	Star		1450
15	West.	SK 70L	1250
15	G.E.	CVC	1250
15	Eck.		1100
15	G.E.	CD83	1150(3)
15	G.E.	RC29	1150(3)
15	West.	SK	1100
15	Cr. Wh.	CMC	900/1800
15	West.	S6	875/1600
15	West.	Sk93	850
15	G.E.	CQC	400/1200
13	Nat.	CS	1100
13	G.E.	RLC	500/1500
13	G.E.	CVC112	1100
13	Diehl		200/247
10	Rel.	34T	1750
10	Cr. Wh.	CM	1450
10	G.E.	RC29	850(2)
10	West.	Sk70	850(2)
10	West.	S	835
10	G.E.	RC29A	825
10	G.E.	CVC	700(2)
10	Diehl		1750
10	All. Ch.	E100	600/1800
10	West.	SK	600/1200
10	G.E.	RF	400/1600
10	West.	SA	400/1200(2)
9	L.-Allis.	NA434	1750
9	G.E.	RF10A	450/1800
8½	Diehl		900/1080
8½	West.	SK	850
8	Cr. W.	SM	910
8	G.E.	RLC	500/1500
15	G.E.	CO	625
7½	Sturt.	TF	3600
7½	Cr. W.	CM	1800
7½	Peerless		1700(2)
7½	Line.	5S	1750
7½	West.	SK43	1450
7½	West.	SK	1150(2)
7½	G.E.	CD73	1150
7/	Cr. W.		900
7½	West.	SK50	975
7½	Niles	Crane	
7½	E.-D.	3S	550/1650
7½	Watson	BW	525/1150
7½	G.E.	RF10	450/1800
7½	West.	SA6	400/1600
7½	G.E.	RLC115	400/1600
7½	All. Ch.		350/1050
7½	G.E.	RLC200	300/1200
7½	G.E.	RLC115	400/1600
6	Roth		1150
6	G.E.	RC29A	850
6	G.E.	RF9	450/1800(2)
5½	West.	SK43	860
7½	G.E.	CO5	1525
5½	G.E.	CVC114	900(2)
7½	G.E.	CQC10	400/1600
5½	West.	SK60	500/1500(2)
5	G.E.	CD	1750
5	R. & M.		1750
5	West.	SK	1700(2)
5	Rel.	HZ	1750
5	G.E.	RC	1700
5	G.E.	CQ	1650
5	G.E.	CVC118	1650
5	G.E.	RC7	1150
5	G.E.	CVC65	1150
5	West.	Sk30	1100(2)
5	All. Ch.	E70	1150
5	G.E.	CVC113	1130(4)
5	G.E.	CQ	1100
5	G.E.	RC27A	1150(2)
5	Cr. W.	CM	960(3)
5	West.	S3	870/1750
5	Sprague	RF5	950
5	Cr. W.	CCM	950(2)
5	West.	SK40	850(2)
5	G.E.	CD73	850
5	Cont.	D49	600/1800
5	Cr. W.	CM	500
5	Star	SP10	600/1200
5	El. Dyn.	3S	550/1650
5	G.E.	CR	500/1500(3)
5	G.E.	RLC114	450/1800
5	G.E.	RF9	450/1800
5	G.E.	CVC114	600
5	G.E.	RF9	450/1350
5	West.	SA5	400/1200
5	El. Dyn.		275/1100
5	G.E.	LC	850/1050
4	Diehl	C404	1150
4	Cr. Wh.	CM	780
4	Northern	Crane	800
3½	L. Allis	Vert.	1750
3½	Cr. Wh.	Ser.	1150
3½	West.	S2	975
3½	West.	Sk90	850/1600
3½	West.	Sk30	850(3)
3½	Diehl	K	550
3½	El. Dyn.	3S	485
3	Star		1750
3	R. & M.	S125	1750
3	West.	CD926	1750
3	G.E.	RC25	1800(4)
3	G.E.	CO	1650
3	Sprague	Lundell	1350
3	G.E.	CD	1200(2)
3	G.E.	RC26A	1150(2)
3	Mar. Card		1200
3	West.	SK20	1150(4)
3	West.	W254	1150
3	Star	SBF	1200
3	Master		1200
3	G.E.	CVC112	1100
3	Cr. W.	CM	1050
3	Line.	Vert.	900
3	Amer. Ldry.		900
3	Diehl	C404	850
3	G.E.	CV65	850
3	G.E.	RF7	650/1300
3	Sprague		650
3	Roth		500/2200
3	G.E.	RL55	500/1500
3	G.E.	RLC111	500/1500
2½	West.	SK20	900/1800
2½	Garwood		600
2½	Diehl	LS	700/1400
2½	G.E.	RC4	1000
2½	West.	SK30	480/1800
2	Watson		1800(3)
2	West.	CD	1725(2)
2	Burke	AB2	1700
2	Cr. W.	CM	1600
2	West.	CD	1180
2	Watson	AW	1150
2	Cr. W.		1150
2	Sturt.	D	1150
2	R. & M.		1150
2	Star	SB2	900
2	West.	SK20	850(3)
2	Diehl	LS	700/2100
2	Sprague	RT3	700/1400
2	Rochester		600
2	Rel.	D	400/1200
1½	Cr. W.	CM	460
1½	El. Dyn.	1S	650/1300
1½	G.E.	RA	1700(2)
1½	G.E.	BD	1750(2)
1½	Watson	AW	1750
1½	West.	CD	1725
1½	Eck.		1300
1½	Roth		1200
1½	Cr. W.	CM	1250
1½	West.	SK8C	1140
1½	Cr. W.	CM	950
1½	West.	Sk10	900(3)
1½	Sturt.	D	850
1½	Diehl	G304	800
1½	West.	SK43	260/1000
1½	Cr. W.	CM	500(3)
1½	Cr. W.	CM	1175
1	Eck.		2400
1	Watson		1800
1	West.	CD	1725
1	G.E.	RC22	1700
1	Cr. W.	CM	1625
1	Eck.		1450
1	West.	CD	1450
1	N. W.	Crane	1300(6)
1	G.E.	CQ	1275
1	G.E.	BD 224	1150
1	Cr. W.	CCM	1200(2)
1	G.E.	RC4	1150
1	West.	CD	1140
1	Watson		900
1	G.E.	CD55	850(2)
1	G.E.	RL54	575/1725
1	El. Dyn.		600
1	Diehl		470
1	Rel.	RC6	450
1	Rel.	T	54/108

300 additional 230 V. DC Motors from 1/6 HP to 1 HP various speeds.

ONE YEAR GUARANTEE

New York City's Largest Stock Electrical Equipment

L. J. LAND & CO.

146 GRAND ST. *CAnal 6-6976* **NEW YORK, N. Y.**

READING, PA.
10TH AND EXETER STS.

YORK, PENNA.
227 NORTH GEORGE ST.

The HEAT is on — America needs more POWER

and HERE IT IS READY FOR SHIPMENT

BOILERS

3—800 HP B & W Straight Tube Waste Heat Boilers, 200 lbs. pressure, complete with Economizers, motor driven induced draft fans, and steel stacks.
2—800 HP Edgemoor Waste Heat Boilers, 200 lbs. pressure complete with Economizers, Super Heaters, motor driven blowers and steel stacks.
2—400 HP B & W Straight Tube Water Tube Boilers, 200 lbs. pressure complete with Combustion Engineering Type E stokers and induced draft fans.
2—400 HP B & W Straight Water Tube Boilers, 160 lbs. pressure, hand shaking grates.
2—253 HP Heine Water Tube Boilers, 160 lbs. pressure, ASME code.

CONDENSER

1—C. H. Wheeler 3650 Square Feet Surface Condenser 2 pass, complete with pumps

GENERATOR

45 KW Diehl Cpd. Int. 550 RPM 230 V. D. C. Generator

★ MISCELLANEOUS

1—16 ton 50 ft. span overhead travelling crane, hand operated
Large lot leather belting (approx. 7 tons) all sizes
Large lot new bronze valves 2" to 4"
Steam pumps—Sump pumps
Thousands of feet of Conduit

PUMPS

2—Steam driven Feed Water Pumps, 14 x 20 x 22 x 15.
1—Cameron Centrifugal Feed Water Pump, motor driven, 150 HP.

Complete Coal Pulverizing Department consisting of:

4—Fuller Lehigh Pulverizers—Jeffreys 24 x 24 Coal Crusher, Ruggles 6' x 41' Rotary Dryer, Conveyors, elevators, etc.
1—Cochrane Feed Water Heater.

STEAM ENGINES D C Current

1—Cooper Tandem Compound Corliss Engine 24 x 54 x 48. Rope drive.
1—Cooper Tandem Compound Corliss Engine 20 x 44 x 48. Rope drive.
1—20 x 36 x 42 Horizontal Cross Compound Corliss Engine. Rope drive.
3—800 KW, one 750 KW, one 400 KW Horizontal Cross Compound Corliss Engines direct connected to 230 volt DC Generators.
3—400 KW, one 450 KW, one 575 KW Horizontal Cross Compound Engines direct connected to 230 volt DC Generators 100 RPM.
1—Ames Vertical Unaflow 4 cylinder 14 x 18 Engine, 150 lbs. pressure 0-5 lbs. back pressure, direct connected to Crocker Wheeler 250 volt DC Generator, 300 RPM.
1—Skinner Unaflow Engine, 150 lbs. pressure, 250 RPM, direct connected to 100 KW Westinghouse DC Generator, 115 volt.
1—Chandler & Taylor 13 x 16, 80 HP, 200 RPM, 100 lbs. pressure.

COMPLETE BOILER PLANT

New 1934

Consisting of:

3—167 H.P. Wickes H.R.T. Boilers, 150 lbs. press. A.S.M.E. code. Each complete with Combustion Engineering Type E underfeed motor driven stoker.
2—10x6x12 Duplex boiler feed pumps.
1—Cochrane feed water heater.
Complete monorail system for handling coal and ashes with two AC hoists.

★ MOTORS ★

230 V. DIRECT CURRENT

Q.	H.P.	Make	Type	R.P.M.
1	300	ELEC. DYN.		500
1	150	WSGHSE	SK	1750
1	125	GEN. ELEC.	DLC	550
		3 PH. 60 CYCLE AC 220/440 VOLT		
		SQUIRREL CAGE		
1	125	Cr. Wh.	125Q	900
1	50	GEN. ELEC.	KT327	1800
1	50	WAGNER	22VRM	600
		SLIP RING		
2	150	Al. Ch.		600
1	150	WSGHSE	H.F.	495
1	50	WSGHSE	CW758	720
		SYNCHRONOUS		
1	450	WSGHSE	550	600
1	268	GEN. ELEC.	2300	600
1	125	WSGHSE	2400	900

Hundreds of other motors from 1 HP up.

•TUBES

CONDENSER TUBES
7,500 Condenser Tubes 1" OD 20 Gauge
Admiralty 18 ft., long like new

BOILER TUBES
212 New Seamless 3½" 10 ga. boiler tubes 17'1" long.

Send for Bulletin #P-100

HEAT and POWER Company, Inc.

45 BOND STREET **Phone: ALgonquin 4-3874** **NEW YORK, N. Y.**

POWER PLANT EQUIPMENT CO., INC.

39 Cortlandt Street
New York, N. Y.

A C TURBINE UNITS

1875 KVA Al. Chal. 2300 V.; Cond.
937 KVA Al. Chal. 2300 V.; Cond. (300#)
937 KVA G.E. 2300 V.; Cond.
780 KVA Al. Chal.-Terry (bleeder) 600 V.
780 KVA Al. Chal. 2300 V.; Cond.
625 KVA Wghse. 2300 V.; Cond.
500 KVA Wghse. 480 V.; Non-Cond.
375 KVA G.E. 2300 V.; Cond.
375 KVA G.E. 2300 V.; Non-Cond.
312 KVA Elliot 480 V.; Cond.
312 KVA C.W.-Moore, Non-Cond. (450#)
175 KVA Al. Chal.-Sturtdevant 220 V.; Non-Cond.

STEAM ENGINE SETS

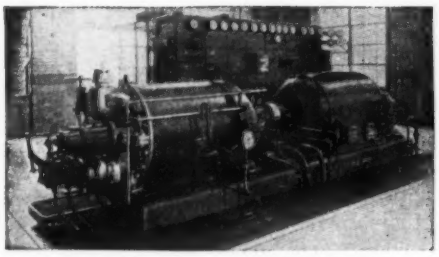
375 KVA G.E.-E.B. 4 Valve; 480 V.
300 KW G.E.-Skinner Uniflow; 250 V. DC
255 KVA G.E.-Hamilton Corliss; 240 V.
210 KVA G.E.-Skinner Uniflow; 480 V.
200 KW G.E.-Skinner Uniflow; 125 V. DC
200 KW G.E.-E.B. 4 Valve; 125 V. DC
150 KVA G.E.-Skinner; 220 V.
125 KW G.E.-E.B. 4 Valve; 250 V. DC
100 KW G.E.-E.B. 4 Valve; 250 V. DC
100 KW G.E.-E.B. 4 Valve; 125 V. DC

STEAM ENGINES

Twin 22 x 36 Nordberg Uniflow
18 x 20 Ames Uniflow
SPECIAL—937 KVA GENERAL ELECTRIC 3-60-2300 V. CONDENSING TURBO GENERATOR SET; EXCITER; SURFACE CONDENSOR; SWITCHBOARD.

COAL PUVERIZERS

8000 lb. Fuller-Bonnet
4500 lb. (2) Erie City Unitype



• BLEEDER TURBINE UNIT

625 KVA Allis Chalmers-Elliott 3 ph. 60 cy. 240/480 v.; automatic bleeder; with jet or surface condenser

DIESEL ENGINE SETS

375 KVA Wghse. 3 ph., Busch-Sulzer
312 KVA Burke 3 ph.—Anderson
200 KVA G.E. 3 ph.—Busch-Sulzer
175 KVA F.M. 3 ph.
60 KVA (2) G.E. 3 ph.—Tipps
40 KVA F.M. 3 ph.
50 HP F.M. "VA" belted

TRANSFORMERS

687 KVA (2) Maloney 13,800-460 V.
500 KVA (3) Al. Chal. 33,000-440 V.
500 KVA (3) Pittsburgh 2300-220/440 V.
250 KVA (3) Packard 22,000-2300 V.
150 KVA (2) Maloney 2300-230/460 V.
100 KVA (3) Al. Chal. 22,000-440 V.
30 KVA (4) Packard 6600-110/220 V.

BOILERS

749 HP (4) Edgemoor 200 lbs.
728 HP E.C. ver. 200 lbs.
600 HP Heine 200 lbs.
600 HP Connelly 200 lbs.
600 HP (3) Sterling 200 lbs.
500 HP (4) Vogt 225 lbs.
471 HP E.C. ver. 160 lbs.
205 HP Heine 165 lbs.

HEATERS

240,000 lbs. Griscom-Russell
170,000 lbs. Hoppes

SURFACE CONDENSOR

625 Sq. Ft. Wheeler

AIR COMPRESSORS

2200 CFM Nordberg—Motor & Steam Driven
250 CFM Penn.—Motor Driven

PUMPS (motor driven)

3600 GPM 85′ head
3000 GPM 100′ head
850 GPM 243′ head
750 GPM Hill 231′ head
650 GPM DeLaval 810′ head
600 GPM Al. Chal. 450′ head

STOKERS

Combustion Engineering for 250 HP
Illinois Chain Grate (2) for 350 HP
Westinghouse for 700 HP
Illinois Chain Grate for 1300 HP

THE PICK OF POWER EQUIPMENT

TURBO UNITS—60 Cy.

1—18750 KVA Westinghouse Cond.
1—12500 KVA Westinghouse Cond.
1—12000 KW General Electric Cond.
1— 6250 KVA General Electric Cond.
1— 4000 KW General Electric Cond.
1— 4000 KVA Allis Chalmers Cond.
1— 3125 KVA General Electric Cond.
1— 1250 KVA General Electric Cond.
1— 937 KVA General Electric Cond.
1— 750 KVA General Electric Cond.
1— 375 KVA General Electric Cond.
1— 250 KVA General Electric Cond.
1— 1500 KVA Allis Chalmers Non-C.
2— 1250 KVA General Electric Non-C.
1— 938 KVA West. 375# I.P. 100# B.P. NC.
1— 625 KVA General Electric Non-C.
1— 312 KVA Moore Non-Condensing
1— 250 KVA Westinghouse Non-C.
1— 125 KVA Westinghouse Non-C.

STEAM ENGINE UNITS—60 Cy.

1—1067 KVA Nordberg Uniflow
1— 325 KVA Skinner Uniflow
1— 300 KVA Hamilton 4-valve
1— 250 KVA Ridgway 4-valve
1— 210 KVA Skinner Uniflow
1— 187 KVA Chuse Uniflow
1— 94 KVA Ridgway 4-valve

OIL & GAS ENGINE UNITS—60 Cy.

1—1000 KVA Cooper (gas) 240 V.
1— 400 KW West. (gas) 440 V.
2— 375 KVA Sterling Viking (gas) 480 V.
1— 312 KVA Anderson 2400 V.
2— 125 KVA Sterling Petrel (gas) 480 V.
1— 121 KVA Fairbanks Morse 240 V.
1— 49.5 KVA Fairbanks Morse 120 V.
1— 32 KVA Fairbanks Morse 120 V.

SYNCHRONOUS MOTORS—60 Cy.

1—1000 HP Westinghouse 2300 V. 900 RPM
1— 750 HP Westinghouse 2300 V. 720 RPM
1— 200 HP General Electric 2200 V. 1800 RPM
1— 175 HP General Electric 230 V. 225 RPM
1— 175 HP General Electric 220 V. 200 RPM
1— 150 HP General Electric 440 V. 164 RPM
1— 100 HP General Electric 2300 V. 240 RPM

DC STEAM ENGINE UNITS

1—500 KW Skinner Uniflow 250 V.
1—350 KW Ridgway 4-valve 250 V.
1—300 KW Skinner Uniflow 250 V.
1—200 KW Ridgway 4-valve 250 V.
1—150 KW Ames Uniflow 125 V.
1—125 KW Ridgway 4-valve 250 V. 3-wire
1—100 KW Ames Uniflow 120 V.
1—100 KW Elliott 4-valve 250 V. 3-wire
1— 75 KW Skinner Uniflow 250 V.
1— 50 KW Ames Uniflow 125/250 V. 3-wire

WATER TUBE BOILERS

2—1000 HP Heine 250-lb. Oil Fired
1— 800 HP Connelly 250-lb. Stoker
4— 750 HP Edge Moor 200-lb.
6— 600 HP Stirling 180-lb. Stokers
6— 600 HP B. & W. 160-lb. Stokers
2— 490 HP Stirling 200-lb.
2— 336 HP B. & W. 200-lb. McClave-Brooks Stokers
1— 253 HP Stirling 180-lb.
2— 250 HP Heine 160-lb.
1— 250 HP Heine Marine 165-lb.

INDUCTION MOTORS—60 Cy.

4—3500 HP G. E. slip ring 2300 V. 120 RPM
1— 800 HP West. slip ring 440 V. 353 RPM
2— 800 HP G. E. slip ring 2300 V. 300 RPM
1— 600 HP G. E. sq. cage 440 V. 900 RPM
2— 400 HP G. E. slip ring 3800 V. 1800 RPM
2— 300 HP G.E. sq. cage 440 V. 600 RPM
2— 250 HP G. E. sq. cage 4000 V. 1200 RPM
1— 250 HP G. E. slip ring 2200 V. 450 RPM
3—50-150 HP West. 2200 V. 343-679 RPM

MOTOR GENERATOR SETS—60 Cy.

1—1500 KW General Electric 600 V. DC
1—1000 KW General Electric 600 V. DC
2— 500 KW General Electric 600 V. DC
1— 75 KW General Electric 125 V. DC

OIL CIRCUIT BREAKERS

2— 600 A. 73 KV West. G222AS Outdoor
1— 400 A. 73 KV G. E. FKO 36 Outdoor
6— 400 A. 37 KV G. E. FHKO136 Outdoor
4— 400 A. 34.5 KV Condit F-16-A Outdoor
2—1000 A. 30 KV Kelman CB-76 Outdoor
4— 600 A. 25 KV West. CO-2 Outdoor
2— 600 A. 15 KV Kelman CB-76 Outdoor
4— 600 A. 15 KV G. E. FKO-60-B Outdoor

FREQUENCY CHANGERS

2—3125 KVA West. 25/62½ cy. 750 RPM
1—3000 KVA G. E. 60/25 cy. 300 RPM
1—2500 KVA West. 25/60 cy. 300 RPM
1—1500 KW G. E. 25/60 cy. 300 RPM
1—1250 KVA G. E. 25/62½ cy. 750 RPM
1—1000 KVA G. E. 60/25 cy. 514 RPM
1—1000 KW G. E. 25/60 cy. 300 RPM
1— 750 KVA G. E. 25/60 cy. 300 RPM

SYNCHRONOUS CONDENSERS

1—2000 KVA G. E. 11000/2200 V. 720 RPM
1—2000 KVA C. W. 11000 V. 600 RPM
1—1000 KVA G. E. 2300 V. 900 RPM
1— 500 KVA West. 2200 V. 900 RPM

TRANSFORMERS 1 Ph. 60 Cy.

3— 600 KVA West. 120,000/2300 V.
3— 200 KVA G. E. 66000/13200-22800 V.
3— 500 KVA Allis 33000/480 V.
6— 250 KVA Penn 34500-17250/4600-2300 V.
3— 75 KVA G. E. 33000/13200-11000 V.
2—10000 KVA G. E. 26400/4580 V. 3 ph.
1— 6000 KVA G. E. 26400/2300 V. 3 ph.
3— 1500 KVA Pitts. 22000/6600 V.
2— 1000 KVA G. E. 23000-11500/575 V.
4— 667 KVA West. 22000-11000/2300 V.
3— 250 KVA G. E. 22000/11000 V.
1—10000 KVA Pitts. 13200/4600 V. 3 ph.
1— 5000 KVA American 13800/2300 V.
6— 1667 KVA Pitts. 13200/2300 V.
1— 450 KVA G. E. 13200/240-480 V. 3 ph.
3— 200 KVA G. E. 13200/2300 V.
3— 150 KVA Pitts. 11000/2400 V.
3— 100 KVA West. 11000/250-125 V.
3— 1250 KVA G. E. 6600/550 V.
3— 1000 KVA Pitts. 2300-4600/550 V.
3— 1000 KVA Kuhlman 2300/220 V.
3— 667 KVA G. E. 2300-4000Y/500-480-460 V.
4— 150 KVA G. E. 2400-4160/240-120 V.
6— 100 KVA Pitts. 2300/575 V.

ROTARY CONVERTERS—60 Cy.

1—1500 KW Westinghouse, 250 V.
2—1000 KW Westinghouse, 250 V.
1—1000 KW Westinghouse, 600 V.
1— 750 KW Westinghouse, 600 V.
1— 500 KW General Electric, 250 V.
1— 500 KW General Electric, 600 V.
2— 300 KW General Electric, 600 V.

PARTIAL LIST—WE HAVE ALL CLASSES OF POWER EQUIPMENT

BREW, WOLTMAN & Co., INC.

50 CHURCH STREET, NEW YORK CITY

DEPENDABLE

Turbo-Generators

A PARTIAL LIST OF OUR INVENTORY

1—G.E. 3125-KVA, 3600-RPM, Condensing: 3/60/2300-v, 200#, 100° SH, 28" vacuum: Surface or Low Level Jet Condenser.

1—Westinghouse 2500-KVA, 3600-RPM, Condensing: 3/60/600-v, 200#, 100° SH, 28" Vacuum: Low Level Jet Condenser.

1—G.E., 1875-KVA, 3600-RPM, Condensing: 3/60/600-v, 200#, 100° SH, 28" Vacuum: Surface or Jet Condenser.

1—G.E., 1563-KVA, Non-condensing 3600-RPM, 3/60/600-v: 150#, 100° SH, 20# back pressure.

1—Allis-Chalmers 1250-KVA, 3600-RPM, 3/60/2300-v, 200#, 500° TT: Surface Condenser.

1—Westinghouse, 1250 KVA 250-v, direct current, condensing, 150/250-Lbs., Surface Condenser.

1—Allis-Chalmers 937-KVA, 3600-RPM, Condensing: 3/60/2300-v, 200#, 500° TT: Surface Condenser.

1—G.E., 625-KVA, 3600-RPM, Condensing: 3/60/2300-v, 200#, 500° TT, 28" vacuum.

1—G.E., 250-KVA, Non-condensing, 3600-RPM: 3/60/480-v, 150#, 0° SH, 28" Vacuum, 10# G. back pressure.

WILMS, WEAVER & CO. Penobscot Building DETROIT, MICH.

We Deal in Turbo-Generators Exclusively

Let MacCABE lift your Worries!

230-VDC. CRANE & MILL MOTORS

H.P.	Make	Type	R.P.M.
2—2½	Westinghouse	K-1	
2—3½	G.E.	C.O. 2503	975
1—1	P & H	5½ x 3½	850
1—2	Shaw	Class BE	930
1—2½	Reliance —	T-224	1600
1—6	Crocker Wheeler	Size ML	930
2—6	G.E.	C.O. 1805	1150
1—7½	Westinghouse	MT 000	650
1—7/10	G.E.	MD 102	1000/700
1—10¾	Crocker Wheeler	Size 6K4	810
1—10	G.E.	C.O. 2504	700
2—11	Westinghouse	K-5	700
1—19	Crocker Wheeler	Size BW	
1—20	G.E.	C.O. 2504	850
4—30/45	G.E.	MD 104½	
1—50	G.E.	C.O. 1810	725
3—65/85	G.E.	C.O. 1830	700/650
1—85	G.E.	C.O. 1811	550
1—150	Westinghouse	MCB 100	365

SPECIAL 150—G.E., C.H., Westinghouse Drum Controllers, Resistors, Electric Brakes in stock.

25—Sets G.E. Controllers, Type R-177 H, 20 to 40-HP. with Resistors.

GENERAL PURPOSE 230-VDC. MOTORS

1— ½	Crocker Wheeler	Size CM	1400
1— 1	Crocker Wheeler	Size E	1200
2— 2	Allis Chalmers	Size E-50	1750
1— 2	G.E.	RF 4-1	500/2000
1— 3	G.E.	C.D. 555	1150
1— 3	G.E.	RLC 111	750/1500
1— 3	Reliance	T-224	3500
1— 3¾	G.E.	RLC 112	600/1800
3— 5	Westinghouse	SK 30	1100
3— 5	Westinghouse	SK 33	1150
3— 5	Westinghouse	SK 40	850
1— 5	Westinghouse	SK 33	1150/1650
1— 5	Reliance	Frame E	500/1800

H.P.	Make	Type	R.P.M.
1— 5	Reliance	Frame F	450/1800
2— 7½	Westinghouse	SK 60	850
1— 7½	Westinghouse	SK 103	400/1600
1— 7½	Westinghouse	SK 40	1150
1— 7½	Reliance	Frame F	450/1800
1— 7½	Reliance	Frame G	275/1650
1— 8	Westinghouse	SK 100L	300/1200
1—10	Westinghouse	SK 50L	1300
1—10	Reliance	Frame G	400/1200
1—15	G.E.	C.D. 75	1750
1—15	Reliance —	Frame 230T	300/1200
1—15	Allis Chalmers	Shunt	800
1—15	Crocker Wheeler	CCM	800
2—25	Westinghouse	SK 100L	1100
1—40	Reliance	RH (Compound)	1200
1—70	Reliance		600/1200

(Automatic Control For Many of the Above Motors)

220/440-V-3-PH-60-CY MOTORS

1— 3	G.E.	KT 944	860
1— 3	Wagner	11 VRP	900
1— 5	G.E.	KT 254	1800
1— 5	G.E.	KQ 946	1200
1— 7½	Sprague	MT 181	1800
1— 7½	Wagner	TRW 13	1200
1—10/20	G.E.	KT 522Y	600/1200
1—11	Louis Allis	S. R.	1200
1—11	P&H	Size HW 10 A	820
1—15	Electro Dynamic	FR 1601 Bal	1145
1—20	P&H	Size HW 20	840
1—25	Westinghouse	C8	900
1—35	G.E.	Type I—Form K	1800
2—35	Westinghouse	Type CI	720
2—37	G.E.	ITC 5011-A	700 (25 CY)
1—40	G.E.	ITC 5012	600
1—40	G.E.	KT 444	1800
1—50	G.E.	KT527	1800
1—50	G.E.	KT346	870
1—52	G.E.	ITC 5013	600

T. B. MacCABE COMPANY

4306 CLARISSA STREET PHILADELPHIA, PA.

SEARCHLIGHT SECTION

BOILERS

1—813 HP **Edgemoor Boiler,** 200# pressure, Riley underfeed stoker.
2—335 HP **B & W Sectional Header Boilers,** 200# pressure with superheaters, hand fired grates.
2—350 HP **O'Brien Boilers,** Heine type, 160# pressure with chain grate stokers.
2—250 HP **Dillon HRT Boilers,** 150# with oil burners.
1—2100 HP **Badenhausen** 354# pressure with pulverizers and all auxiliaries.
1—1000 HP **Badenhausen Riley** 200# pressure with pulverizer.
1—600 HP **Connelly** 200# pressure.
2—492 HP **Sterling Boilers,** 160# pressure stokers.
1—453 HP **Sterling Boiler** chain grate stoker, 160# pressure.
1—394 HP **Sterling Boiler** chain grate stoker, 160# pressure.
2—250 HP **Sterling Boilers,** 160# pressure equipped with gas burners and controls.
2—253 HP **Sterling Boilers,** 160# pressure with oil burners.
2—250 HP **Wicks Vertical Boilers** 160# pressure with pulverizers.
2—500 HP **Edge Moor Boilers** 200# pressure.
4—500 HP **Voigt Water Tube Boilers** 175# pressure with chain grate stokers and all auxiliaries.
1—440 HP **B & W Sectional Header Boiler** 150# pressure, underfeed stoker.
1—522 HP **Sterling Boiler** 200# pressure with Firite Stoker.
2—484 HP **Springfield Boilers** 200# pressure.
1—484 HP **Springfield Boiler,** 250# pressure oil burners.
1—520 HP **B&W Sectional Header Boiler,** 200# pressure.
1—**Complete Power Plant** consisting of 2—309 HP **Heine Marine Boilers** 225# pressure and 2 General Electric Turbines with all auxiliaries.
5—150 HP **Erie City HRT Boilers,** 125# pressure.
1—300 HP **Locomotive Boiler** 150# pressure with all trimmings.
1—150,000# **Badenhausen Boiler** 350# pressure with pulverizer, all auxiliaries.
3—250 HP **Erie City** vertical boilers with pulverizers.
1—400 HP **Connelly Boiler** 160# pressure with new tubes and auxiliaries.
2—84" x 20' **HRT Boilers,** 150# pressure all auxiliaries.
2—150 HP **Brownell Boilers,** 125# pressure, rebuilt and guaranteed.
56—50 HP **Vertical Boilers** 150# pressure all auxiliaries.

TURBINES

1—5000 KW **Westinghouse** 1800 RPM 3-60-2300 volts Surface Condenser all auxiliaries.
1—3200 KW **Allis-Chalmers Condensing Turbine** with auxiliaries.
1—2500 KW **General Electric Condensing Turbine** with auxiliaries.
1—2500 KW **General Electric Turbine** 400# pressure, Surface Condenser.
1—1000 KW **Westinghouse non-condensing turbine** 350# pressure 16# back pres.
1—937 KVA **Allis-Chalmers Turbine.**
1—625 KVA **General Electric Turbine** with jet condenser.
1—2000 KW **Westinghouse Turbine** with Surface Condenser and auxiliaries 3-60-440 volts.
1—300 HP **Kerr Non-condensing** 3600 RPM Turbine.
1—250 KVA **Waite Turbine** either condensing or non-condensing.
1—250 KVA **General Electric non-condensing Turbine.**
1—125 KW **General Electric non-condensing turbine.**

ENGINE GENERATOR SETS

1—200 KVA **Harrisburg Uniflow Engine Generator Set.**
1—750 KVA **Rice & Sargent** 3-60-600 volt engine generator.
1—480 KW **Rice & Sargent** 3-60-550 volt engine.
1—375 KVA **Chuse Corliss eng. generator.**
1—375 KVA **Chuse vertical Uniflow engine.**
2—312 KVA **Skinner Uniflow engines.**
1—166 KVA **Ames Uniflow engine generator set.**
1—220 KVA **Chuse** non-releasing Corliss engine generator.
1—66" x 125' steel stack.
1—48" x 150' steel stack.

DIESEL ENGINES

1—300 KVA **Fairbanks-Morse** Full Diesel engine generator set.
1—450 HP **Cooper-Bessemer** Tex rope driven to 300 KW AC Generator.
1—**Complete Diesel Plant** consisting of 1—250 KVA **Buckeye Full Diesel,** 1—225 KVA **Atlas Full Diesel,** 1—94 KVA **Caterpillar Diesel.**
4—500 HP **Busch-Sulzer** 6 cylinder oil engines used only 300 hours.

ENGINE GENERATOR SETS

1—625 KVA **Nordberg** Uniflow engine.
1—1000 KVA **Skinner** Uniflow engine.
1—375 KVA **Skinner** Uniflow engine.

MISCELLANEOUS

2—400 GPM **Centrifugal Boiler Feed Pumps.**
1—2000 HP **Cochrane Metering Feed Water Heater.**
1—10' x 15' **Illinois Forced Draft Chain Grate Stoker.**
1—#8 **Fuller Bonot Pulverizer.**
2—Type AA-6 10 retort **Taylor** Underfeed **Stokers.**
2—6 Retort **Taylor** Underfeed **Stokers** with fans.

SEE *Fletcher* FIRST!

FLETCHER SALES CO.
835 Security Trust Bldg. INDIANAPOLIS, IND.

---

230 V. VARIABLE SPEED MOTORS

Below are just a few of the thousand of items we have in Motors, Generators, Turbo Generators, Engine Generators, Motor Generators, Transformers, Circuit Breakers, etc. Please send us your inquiries. What have you for sale?

Qu.	HP.	Make	Type	Speed
16	1½	Gen. Elec.	RA-5	820/1230
1	1½	Gen. Elec.	BD45	850/1350
3	1.1	Gen. Elec.	BD45	850/1350
6	1½	Westgh.	SK-10	740/2200
1	2½	Westgh.	SK-20	740/2200
2	2	Westgh.	SK-33	500/2000
1	3	Gen. Elec.	RF-8	500/1500
1	3½	Westgh.	SK-30	815/1630
1	3½	Westgh.	SK-30	660/2000
1	4	Gen. Elec.	RLC	500/1500
1	5	Gen. Elec.	CD-75	650/1950
1	7½	Gen. Elec.	7½CR	500/1500
3	8	Gen. Elec.	RF-10	400/1500
2	8½	Westgh.	SK-90	350/1400
3	12	Gen. Elec.	RF-10	550/1650
12	15	Gen. Elec.	RF-10	550/1650
1	15	Reliance	131T	500/1000
1	15	Westgh.	SK110L	400/1600
1	20	Gen. Elec.	LO	425/1275
3	20	Westgh.	SK	375/1500
11	20	Gen. Elec.	RF-12	400/1200
1	20	Westgh.	SK110L	500/1500
1	27½	Electro Dynamic	15S	450/1350
2	35	General Elec.	RF-14	250/1000
3	35	Gen. Elec.	RF-13	500/1500
4	35	Reliance	310T	400/1200
2	35	Gen. Elec.	LC	650/1300
3	35	Westgh.	SK160	400/600
1	35	Gen. Elec. (50 HP. mach. tool duty)	CD135	300/1200
1	37	Sunderland Forge & Engine Co. compd.		250/520/750
2	50	Westgh	SK	500/1500

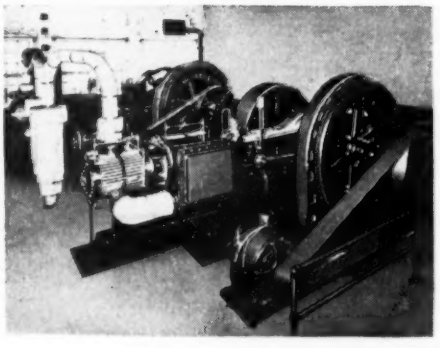
Keystone Power Plant Equipment Co.
8403 Hegerman Street Philadelphia, Pa.

FOR SALE

1—180 H.P. **Allis-Chalmers,** Horiz. 2-Cylinder 16" x 24" Full Diesel Direct Connected to 156.5 Kva. 3/60/2300-Volt Generator.
1—280 H.P. **De La Vergne,** Horiz. 2-Cylinder 20" x 34" Full Diesel Solid Injection, Direct Connected to 250 Kva G-E Generator 3/60/2300 V. Both have Exciters, and Switch Boards

All Ready for shipment—Kansas City.
Write
W. L. Sullivan, P. O. Box 236, Oklahoma City

ENGINE GENERATOR SETS



1—250 K.V.A. and 1—300 K.V.A. Crocker-Wheeler Generator direct-connected to Skinner Tandem Compound Steam Engine 480 Volts 3 phase, 60 cycles A.C. 200 RPM plus Switch-board instruments. Steam Fixtures include Bends and Separators.

BOILERS

1—444½HP Union Iron Works Company double longitudinal drum water tube Boiler. 225 pound pressure. Equipped with Foster superheater. Diamond soot blowers. 1—S.C. regulator Company water column regulator, brick setting, arranged to burn powdered coal.

WRITE, WIRE OR PHONE

EMSCO EQUIPMENT CO.
39 HYATT AVE., NEWARK, N. J.
Emil A. Schroth, owner Phone—Mitchel 2-3536

A FEW CHOICE UNITS
NOW RELEASED

TURBO ALTERNATORS 60 cycle

		(150-200#)		
500 KW	2300 V	Surf. Condenser in Texas	G.E.	(1914)
500 KW	2300 V.	Surf. Condenser in Arkansas	Allis	(1911)
750 KW	575 V.	Non Cond. 5# B.P. in New York	W. H.	(1909)
750 KW	2300 V.	SURF CONDENSER IN ARKANSAS.	G. E.	(1922)
750 KW	188 V.	Jet Condenser in Pennsylvania	G. E.	(1917)
500 KW	2400 V.	JET CONDENSER IN KENTUCKY	WH	(1926)
400 KW	480 V.	5# GBP NEW	WH	(1929)

350# I.S.P.

2500 KW 2300 V. Surf. Condenser very fine unit

BOILERS

2—400 HP	200#	Code (1925)	Sectional Hdr.	Stokers
1—250 HP	160#	Code	Stirling	Stokers-Auxlrs.
3—500 HP	150#		Sickes Vert.	In Kansas
2—400 HP	200#	Precode	Sectional Hdr.	Stokers-Auxlrs.
1—700 HP	200#	Code (1922)	Erie City	Ins. Co. Approved
2—270 HP	180#	Precode	Sectional Hdr.	Ins. Co. Approved Grates
2—300 HP	175#	Precode	Heine	Ins. Co. Approved
1—300 HP	200#	Precode	Sectional Hdr.	
1—600 HP	150#	Code	Connelly	Ins. Co. Approved
1—650 HP	200#	Code	Edgemoor	1923

6 retort Wemco stoker and drive.

MOTORS

Synchronous 440 V. 164 RPM (1918)

1—620 HP at units PF 500 HP at 80%. Switchboard, etc. Exciter (belted) 2 bearing with pedestal & floor plate

Slipring 440 V. 350 RPM

1—800 HP and 1—600 HP

Induction 550 V. 690 RPM

1—100 HP Adjustable base
1—150 HP Double end shaft

PAUL STEWART & COMPANY

MAIN 3427 MAIN 3428 — UNION TRUST BLDG.

CINCINNATI, O.

MOTORS • GENERATORS • TRANSFORMERS

Prices on Application

3 PHASE, 60 CYCLE, 220/440 V.

HP	Make	RPM	Type	Frame
5	West.	1200	CCL	2 phase
5	American	600	totally enc.	ball beairng
7½	Gen. Elect.	1800	KT	944
7½	Gen. Elect.	1800	KQ	944 2 phase
10	Fairbanks Morse	900	KBY	
10	Crocker Wheeler	900	Nema	365
10	Burke	1800		
15	Reliance	1200		2 phase
15	Howell	900		2 phase
20	Gen. Elect.	1800	KQ501	2 phase
20	Gen. Elect.	565	I	Form K
25	Gen. Elect.	1740	KQ312	2 phase
25	Armor	1200	ball bearing	2 phase
25	Gen. Elect.	1800	KT	312
30	Gen. Elect.	3600	KT	513
30	Armor	695	ball bearing	2 phase
50	West.	1200	MS	
50	Fairbanks Morse	1800	ball bearing	
50	Fairbanks Morse	1800	ball bearing	
50	West.	1800	CS	
60	Gen. Elect.	1800	I	form K
75	Gen. Elect.	1800	I	form K
75	Gen. Elect.	900	KT	552
100	Gen. Elect.	1800	I	form K
100	West.	1800	CS	
150	Gen. Elect.	1200	I	form K
150	Gen. Elect.	1200	I	form K

MOTOR GENERATOR SETS

1—100 KW Ridgeway Synchronous. 250-275 V. DC.—Motors 3/60/2300/1200 RPM complete with panels.

1—100 KW Westinghouse Synchronous-Generator 250-275 V. DC.—Motor 3/60/2300/900 RPM complete with panels.

1—32 KW Westinghouse M. G. Set. Generator Type SK. 250 V. DC. 1750 RPM—Motor 49 HP. Type CS. 3/220/440/60/1750 RPM complete with panels.

ENGINE TYPE MOTOR
625 Hp. Gen. Elect. Synchronous 3 Ph. 60 Cy., 2300 Volt, 180 Rpm.

25 Rotary Converter
1—150 Allis Chalmers Rotary 250 Volts D.C. 500 R.P.M. complete with panels. Transformer 25 cycle, 2300 volts.

TRANSFORMERS

Amt.	Kva.	Make	Cycle	Voltage
3	25	Gen. Elect.	25	2300/115/230/460
3	40	Gen. Elect.	25	2300/230/460
3	50	Gen. Elect.	60	2300/230/460
3	250	Gen. Elect. (new)	60	13,200/2300
3	200	Kuhlman	60	4160/4600/230/460
3	500	Pittsburgh	25	11,500/220
3	1000	Pittsburgh	60	2300/4600/230/460

3 PHASE, 25 CYCLE, 220/440 VOLTS

HP	Make	RPM	Type	Frame
5	Al. Chal.	720	AR	
5	Wagner	1450	Ball. B.	Enclosed
7½	West.	750	CS	
7½	G. E.	1500	KT	181
10	G. E.	750	KT	312
10	West.	750	CS	
10	West.	1500	CS	
10	G. E.	1500	I	Form K
15	G. E.	750	KT	
15	West.	1500	CS	
20	West.	750	CS	
25	West.	750	CS	
50	G. E.	750	I	Form K
50	West.	750	CS	
75	G. E.	750	KT	357
75	G. E.	750	I	Form K
100	G. E.	300	I 17	Form K
150	G. E.	750	I	Form K
150	G. E.	750	I	Form K
200	West.	460	CS	2200 Volt
200	G. E.	750	I	Form K
225	Elec. Ma.	500	2200 V.	Synchron
1150	G. E.	375	2300 V.	Synchron
200	West.	235	CW	Slipring

Prices on Application

SLIPRING MOTORS

60 CYCLE, 3 PHASE, 220/440 VOLTS

HP	Make	Speed	Type	Frame
10	Gen. Elect.	1800	MT	303
15	Gen. Elect.	1800	I	form M
20	Gen. Elect.	545	MT	332
20	Westinghouse	575	CW	648A
20	Westinghouse	575	CW	ball bearing
25	Westinghouse	690	CW	
30	Gen. Elect.	1800	MT	327
30	Gen. Elect.	1800	I	form M
40	Westinghouse	690	CW	748
40	Westinghouse	690	CW	748A
40	Westinghouse	690	CW	748A
40	Westinghouse	690	CW	748A
50	Westinghouse	900	CW	
60	Westinghouse	720	CW	2200 volt
75	Westinghouse	1800	CW	
500	Westinghouse	600	CW	

25 Cycle Steel Mill Motors

Amt.	HP.	Make	RPM.	Type	Voltage
1—	225	Elect. Mach.	500	Synchronous	2300
2—	750	Gen. Elect.	125	Slip Ring	2300
1—	1000	Allis Chalmers	293	Slip Ring	6600
1—	1150	Gen. Elect.	375	Synchronous	2300
1—	1250	Allis Chalmers	294	Slip Ring	6600
4—	1600	Gen. Elect.	93	Slip Ring	2300
1—	2000	Allis Chalmers	294	Slip Ring	6600
1—	2500	Allis Chalmers	295	Slip Ring	6600
1—	2500	Allis Chalmers	146	Slip Ring	6600
1—	3000	Allis Chalmers	184	Slip Ring	6600
1—	5500	Allis Chalmers	370	Slip Ring	6600

FREQUENCY CHANGERS

2—1250 KVA Gen. Elec. Synchronous—motor 3/25/2200 750 RPM, direct connected to Generator 3/62½/440 V. Complete with exciters and panels.

1—200 KW General Electric 3 ph., 60 cy., 2300 V. direct connected to 290 HP. Gen. Elec. Synchronous Motor, 3 ph., 25 cy., 440 volt, 750 RPM. Complete with panels.

25 CYCLE CRANE MOTORS
10—25 Hp. Gen. Elect. New MTC 5523. 3/25/440/750 Rpm.

ERIE ELECTRIC CO., INC.

124 CHURCH ST. — **BUFFALO, N. Y.** — **CL. 4758**

SLIP RING MOTORS, 3 PH., 60-CY.

HP	Volts	Make	Speed
700	2200	G.E.	900
400 (2)	400	Whse.	514
350	220–440	G.E.	1800
350	2200	G.E.	600
300	2300–4000	G.E.	1200
250	440–550	G.E.	600
200	2200–550	G.E.	1800
200	2200–400	G.E.	600
150	440–220	G.E.	1800
150	2200	G.E.	900
150	2200–440	Whse.	1800
150	550–2200	G.E.	1800
125	440–220	G.E.	600
100	550–2200	G.E.	720
100	440–220	G.E.	1800
100	220–440	G.E.	720
100	220–440	G.E.	900
75	220–440	G.E.	600

SYNCHRONOUS MOTORS, 3-PH., 60-CY.

600	2200	Whse.	900
400	440–220	Whse.	276
350	440–220	G.E.	900
240	2300–440–220	G.E.	600
200	2300–4000	G.E.	1200
150	2200	G.E.	1800
100	440–220	G.E.	1200

PUMP

1—8" Dredge Pump 1880 GPM, 120' Morris Machine Works with direct connected Slip Ring Motor 125 HP, 600 RPM, G.E.

AIR COMPRESSOR

1—465 CFM Ing. Rand Motor Driven Air Compressor Unit Type XRB 8" x 13" x 10" 300 RPM—100# Gu. No. 89242-3 driven by 75 HP GE AC Motor complete all Accessories including Receiver.

TRANSFORMERS—60 CYCLE

3—667 kva., G.E., 2300/4000-460/480 Volts.
3—667 kva., Whse. 22000-2300.
3—500 kva., Whse. 22000-2300.
3—350 kva., G.E., type H-KD 13200-2300.
3—333 kva., G.E., type H-KDD 2400-460/230.
3—250 kva., Whse. 13,800-460.
3—200 kva., G.E., type H 10000-600.
3—200 kva., G.E., H-KD 6600-2300/4000Y., 25 cy.
3—175 kva., G.E., 4000-480.
3—150 kva., G.E., type H-KDD 13200-2300.
3—150 kva., Al. Chal., type OISC 10400-2400.
1—100 kva., Pittsburgh, type OISC 2400-240-120.
3—100 kva., G.E., type H 2400-240/480.
3—100 kva., G.E., type H-KDD, 6900/11950Y-230/115.
3—100 kva., Whse. 22,000-2300.
2— 75 kva., G.E., type HK, 2300-230/115.
3— 50 kva., Moloney, 2300-230/115.
6— 50 kva., Whse. type SK, 13800-240/120.
3— 50 kva., Whse. 22,000-2300.

SQUIRREL CAGE MOTORS

HP	Volts	Make	Type	Speed
500	440/220	G.E.	IK	1200
500	440/220	G.E.	IK	900
400	2200	Whse.	C.S.	1800
300	2200	G.E.	IE-K	1800
250	2200	G.E.	IK	600
200	220/440	G.E.	IK	720
150	2200	Allis. Ch.	AN	450
100	2200	G.E.	IK	600
100	2200	G.E.	IE-K	1800
100	550	G.E.	KT	900
100	220/440	G.E.	KT	720
75	2200	G.E.	KT	900
75	2300	G.E.	IE-K	1800
50	220/440	G.E.	K	1800

MOTOR GENERATOR SETS

1—250 KW 250 V. 1200 RPM GE Conn. to 375 HP 2300 V. 3 ph. 60 cy. syn. motor.
1—75 KW 125 V. 1200 RPM, GE Conn to 100 HP 440 V. 3 ph. 60 cy. Ind. motor.
1—75 KW. 250 V. 1800 RPM, Cr. Wh., Type CCD con. to 100 H.P., 2200 V., 3 ph., 60 cy.
1—250 KW Motor Generator Set, very modern, practically new, see further description under that heading.

A.C. GENERATORS

1—500 kva., 900 r.p.m., 2209 V. Whse. Condenser.
1—300 kva., 900 r.p.m., 240/480 V., G.E.
1—225 kva., 600 r.p.m., 2200-240 V., G.E.
1—187 kva., 900 r.p.m., 2200-550 V., Westghse.

STEPHEN HALL & CO.

HARRY J. RICE PRES.

458 SEVENTH ST. HOBOKEN, N. J.

STEAM PUMPING ENGINES

1—**Snow** 6 mgd. C&FW Cr. Com. Opp. Type Cond. 20-40x14¾x36, with waterwork type cond.
1—**Allis-Chal.** 4 mgd. cr. com. cond. size 12x28x13x24. Fine cond.
Worth. Dup. Pump size 16x12x12, cap. 1100 gpm. heavy water wks. type.

PUMP VALVES

Birch Valves for reciprocating pumps.

LARGE GATE VALVES

4—48" **Chapman** Motor operated solid wedge gate valves non-rising stem.
1—20" **Rensselaer** #13 Iron Body Bronze Mounted Hub End Gate Valve with 16" Iron Brass Lined Hydl. Cyl. with indicating Rod & Eyebolt, 160#
1—20" **Crane** 125# Flanged Hand Wheel operating Gate Valve.

SURFACE CONDENSER

1—10 AD 4 pass 210 ft. **Foster Wheeler** over Comb. Air Circulating and Tail Pump.

BIRCH MANUFACTURING COMPANY

1523 Sedgwick St. Chicago, Ill.

NEW AND REBUILT GENERATORS

2—New Kohler 1½ KVA. AC. 1500 watt. gas driven engine 120 volts, single phase, lighting generators.
1—New Kohler, 10 KVA, 120 volts single phase, 60 cycle, gas engine driven generator sets.
2—New Lister-Blackstone "Nite-Hawk" Portable 5 KW 120 volts, AC. generator Sets, complete with four 1000 watt reflectors mtd on 8' telescopic extensions mtd on two wheel spring mtd trailer.
1—New Kohler, 5 KVA, 120 Volts, gas engine driven Generator.
5—New Universal 5 KVA, 120 Volts, gas engine driven generators.
1—Rebuilt 20 KW, 125 volts, Fairbanks-Morse Diesel Generator.
2—Rebuilt 15 KW, 110 volts, Allis-Chalmers gas eng. driven Gen.
1—Rebuilt 50 KVA Superior diesel eng. driven Gen., V-belt drive 220 volts, 3 phase, 60 cycle, AC Generator, .8 power factor, powered with Superior 100 H.P. 6 cylinder diesel engine.
1—Rebuilt 18.7 KVA Superior diesel engine driven Generator, direct connected, powered with 2 cyl. eng., 1200 r.p.m. and Columbia Generator, 220 volts, 3 phase, 60 cycle, .8 power factor. Machine in excellent condition.
1—Rebuilt Buda 15 Kw gas engine driven Generator Set, 110 volts DC.
1—Rebuilt 7½ KW Winton gas eng. driven, 110 volt. DC Gen. Set.

CCEC — CHICAGO CONSTRUCTION EQUIPMENT CO. — 13912 SOUTH HALSTED ST. • CHICAGO, ILL. — PHONE RIVERDALE 1300

BOILERS

NEW and USED!

All makes & sizes for prompt shipment

2—500 H.P. Stirling 160#
1—312 H.P. Stirling 160#
3—300 H.P. B & W 150#
1—200 H.P. Heine 160#
1—516 H.P. Stirling 200#

We want to buy 50 HRT boilers from 100 to 200 H.P. 125# pressure or better.

J. F. DAVIS CO.

122 S. Michigan Ave. CHICAGO

Motor Generator Sets—Synchronous Motors, etc.

MOTOR GENERATOR SETS & ROTARIES
3 phase, 60 cycle, A.C.

1—Allis-Chalmers 300 KW 250 Volt M-G sets, 2300 V. A.C.
1—Ridgway 100 KW 250 V. M-G set 2300 A.C.

VERTICAL MOTORS

1—G. E. 50 HP 1200 RPM 3 ph 60 cy 220 V.
1—Reliance Fan-cooled 25 HP 1750 RPM 220/440 V.

SYNCHRONOUS MOTORS
3 phase, 60 cycle, A.C.

1—Burke 300 HP 900 RPM 440/220 Volt
1—Ideal 50 HP 600 RPM 2300 Volt

SLIP RING MOTORS, 3 phase, 60 cycle

Allis-Chalmers 250 HP 600 RPM 440 Volt
G. E. 60 HP 600 RPM 440 Volt
G. E. 62½ HP 1150 RPM 440/220 Volt

SQUIRREL CAGE MOTORS
3 phase, 60 cycle, 220/1440 Volts

1—150 HP 1750 RPM Allis-Chalmers
2—100 HP 550 RPM Westinghouse MS
1— 75 HP 575 RPM Westinghouse CS—368-A
1— 75 HP 600 RPM Fairbanks-Morse
1— 75 HP 720 RPM Lincoln 1-P
1— 65 HP 860 RPM Allis-Chalmers
1— 50 HP 690 RPM Westinghouse CS—758
1— 50 HP 875 RPM Westinghouse CS
1— 50 HP 865 RPM Ideal
1— 50 HP 1200 RPM Northwestern H-50
1— 50 HP 1750 RPM Westinghouse CS—53-C
5— 20 HP 870 RPM West. T.E.F.C. CS—W-405
2— 20 HP 870 RPM West. CS—W-405
2— 15 HP 860 RPM Allis-Chalmers

ALTERNATOR SPECIAL, Allis-Chalmers, 125 KVA, 277 RPM, 3 phase, 60 cycle

The Electric Motor & Repair Co., Cuyahoga Falls, O.

120 KW ENGINE GENERATOR SET

1—120 KW G.E. Co. Type TRE Generator, 3/60/2300 volts, direct connected to 125# Harrisburg Fleming Steam Engine.

HOIST

1—50 HP Lidgerwood Double Drum Hoist, 24x24" drums, side by side, with or without AC or DC motor.

DEEP WELL PUMPS

2—600 GPM, 116 ft. head, Kingsford, size #4 Deep Well Pumps with 40 HP G. E. Co. Type CD-35, 230 V. DC vertical motors.

CRUSHERS

2—Size 36" x 48" Link Belt Double Roll Coal Crushers, product size, 1½" to 3", spring relief type.

ELECTRIC EQUIPMENT
FOR
INDUSTRY

LET US KNOW YOUR REQUIREMENTS

REBUILT & GUARANTEED STOCK
MOTORS, D.C. & A.C. TRANSFORMERS
MOTOR GENERATOR SETS
ROTARY CONVERTERS
SWITCHBOARDS BUILT TO ORDER

SYNCHRONOUS MOTORS

2—150 HP W.H. Co. Type G, 80% P.F. for 3/60/220-440 volts, 1200 RPM, with direct connected exciters.
2—250 HP W.E. Co. Type HR, 100% P.F. for 3/60/2300 volts, Engine Type, one (1) at 240 RPM, one (1) at 277 RPM.

100 KW ROTARY CONVERTER

1—100 KW G.E. Co. Type TCC for 250 V—DC and 3/60/2300 V—AC. Transformer and Switchgear. 1200 RPM.

CENTRIFUGAL PUMPS

2—2700 GPM, 170 ft. head Lecourtnay Centrifugal Pumps driven by 150 HP W.H. Co. Type G, 80% P.F. Synch. motors 3/60/220-440 volts, 1200 RPM.

PLATFORM SCALE

1—15 ton Fairbanks Industrial Platform Scale, 5' x 8'.

FREQUENCY CHANGERS — TURBO GENERATORS — AC & DC MANUAL MAGNETIC CONTROL — CENTRIFUGAL PUMPS — AC & DC SWITCHBOARDS

FOR DETAILS, WRITE **JOHN D. CRAWBUCK CO.** 714-15 EMPIRE BLDG. PITTSBURGH, PENN.

SEARCHLIGHT SECTION

1—400 HP Westinghouse, type CW, 3 ph, 60cy, 440V, 450 RPM slip ring motor

1—300 HP Westinghouse, 3 ph, 60cy, 440V CW slip ring motor 495 RPM

3—250 HP General Electric, 3 ph, 60cy, 440V I-17A 400 RPM

1—200 HP Allis Chalmers, 3-60-440V, 514 RPM

2—150 HP Allis-Chalmers, 3 ph, 60cy, 440V, 450 RPM slip ring

1—150 HP General Electric type KT, fr. 558 3-60-2200V 880 RPM

1—150 HP General Electric, type ATI, 3 ph, 60cy, 440V 900 RPM. 0.8 PF syn. motor

1—150 HP Electric Mach. syn. motor 125 KVA, 3-60-220V, 1200 RPM

1—150 HP General Electric, 3-60-440V 1-17A 360 RPM slip ring

1—150 HP Westinghouse, 2 ph, 60cy, 440V frame 1000, CW, 390 RPM slip ring

2—125 HP Westinghouse CS774C 3-60-440V 860 RPM Ball bearing.

4—100 HP General Electric, 3-60-440V 495 RPM, MT562 slip ring

1—100 HP General Electric type I, form K, 3-60-220V 575 RPM

1—100 HP Westinghouse, type CCL, 3 ph, 60 cy, 2200V, 1750 RPM, Squirrel Cage

1—100 HP Allis-Chalmers, type ANY, 3 ph, 60 cy, 220V, 690 RPM slip ring

2—75 H.P., 300-foot head Pumps: 2200V Fairbanks-Morse, 1800 RPM 3ph 60cy slip ring motors direct connected to 500 GPM 3 stage

1—75 HP Allis-Chalmers, 3 ph, 60 cy, 440V, 450 RPM slip ring

1—75 HP Westinghouse, type CW, 3 ph, 60 cy, 440V, 720 RPM slip ring, 3 or 2 bearings

1—75 HP General Electric, type MT, frame 558, 3 ph, 60 cy, 440V, 575 RPM

1—75 HP Fairbanks-Morse, type H, frame 165C, 3 ph, 60 cy, 550V, 900 RPM Squirrel Cage

1—75 HP Lincoln, type IQ, 2 ph, 60 cy, 440V, 600 RPM Squirrel Cage

1—75 HP Reliance, 3 ph, 60 cy, 440V, 720 RPM totally enclosed fan cooled

1—75 HP Allis-Chalmers, 3 ph, 60 cy, 440V, 600 RPM slip ring

1—75 HP General Electric 3 ph, 60 cy, 440V, 600 RPM, MT558 slip ring

1—75 HP Western Elec. type I, 3-60-440V, 690 RPM

1—75 HP General Electric, 3-60-440V, type I, 575 RPM

3—25/65 HP Westinghouse, frame 762C, 3-60-440V, 600/1200 RPM, 2 speed slip ring motor

1—60 HP General Electric type KT, frame 346, 3 ph, 60 cy, 440V, 870 RPM

1—60 HP Lincoln 3-60-220V frame IXM, Sq. Cage 900 RPM

1—60 HP, General Electric, 3-60-440V, 720 RPM, type I form K

1—60 HP General Electric 3-60-440V, 1750 RPM, type I slip ring

1—60 HP General Electric 3-60-440V, KT542, 870 RPM Sq. Cage

1—50 HP General Electric 3-60-440V, 3450 RPM, KT527 tot. encl. fan colled

1—50 HP Wagner (Fynn Weichsel) 3-60-440V, 1200 RPM

1—50 HP General Electric 3-60-220V, 1150 RPM, type I, slip ring

1—50 HP Triumph 3-60-440V, type C12, 1150 RPM, slip ring, rotor & stator rewound

1—50 HP General Electric, 3-60-440V, KT 346, 870 RPM, Sq. Cage

1—50 HP General Electric 3-60-440V, 900 RPM, type I-M, slip ring

1—50 HP Howell 3-60-440V, 870 RPM, type SCBB ball bearing Sq. cage

1—50 HP General Electric 3-60-440V, 720 RPM, type I-K, Sq. Cage

2—50 HP Allis-Chalmers 3-60-440V, 690 RPM slip ring

1—50 HP General Electric 3-60-440V, 690 RPM, MTS 46, slip ring

1—50 HP Ideal 3-60-440V, 580 RPM, type AV, slip ring

3—50 HP General Electric 3-60-440V, 575 RPM, type I-K, fr. 13A, Sq. Cage

1—50 HP Wagner 3-60-440V, 495 RPM, type BM, Sq. Cage

1—50 HP Allis-Chalmers 3-60-440V, 490 RPM, Sq. Cage

1—50 HP General Electric 3-60-440V, 490 RPM, type I-M, slip ring

1—50 HP Westinghouse CS 2-60-440V, 420 RPM, Sq. Cage

We have a stock of 3000 motors from 1 HP to 50 HP in AC and DC. We have a very large stock of air circuit breakers up to 12000 amp.

1—100 HP General Electric, type CD, fr. 123, 230V, 1200 RPM

1—100 HP General Electric, type RF 17, 230V, 400/1200 RPM

1—100 HP Westinghouse type SK, frame 140, 230V, 1700 RPM

1—75 HP General Electric, type CD, fr. 176, 550V, 250/1000 RPM (planer)

1—60 HP Westinghouse, type SK, frame 160, 230V, 680 RPM

1—60 HP Westinghouse type SK140L, 115V, 1150 RPM vertical

1—50 HP Westinghouse, type SK, fr. 160, 230V, 565 RPM

1—50 General Electric, class 5, Form B, 600V, 600 RPM

1—50 HP Westinghouse SK200, 245 RPM, 230V

1—DC Generator 45KW Bullock 120V 375A 900 RPM

2—40 HP C & C 230V, 250/1000 (planer)

25 CYCLE MOTORS

1—50 HP Westinghouse 3-25cy-440V, 720 RPM, type MS, Sq. Cage

1—50 HP General Electric, 3-25cy-440V, 700 RPM, type I-M, slip ring

1—40 HP Westinghouse 3-25cy-440V, 1450 RPM, type CS, Sq. Cage

1—40 HP Westinghouse 3-25cy-440V, 730 RPM, type CI, frame 753A slip ring crane

1—35 HP Allis-Chalmers 3-25cy-440V, 720 RPM, slip ring

1—30 HP General Electric 3-25cy-440V, 1450 RPM, FT 527, vertical B.B.

1—30 HP Westinghouse 3-25cy-440V, 720 RPM, CS, Sq. Cage

The Wente Electric Co.,

Hamilton, Ohio

REBUILT MOTORS & GENERATORS SINCE 1906

SYNCHRONOUS CONVERTERS

500 KW AL-CH. 250 D.C. 2300/4000 A.C. 1200 RPM
500 KW WEST. 250 D.C. 2300/4000 A.C. 1200 RPM
300 KW G.E. 600 D.C. 2300/4000 A.C. 1200 RPM
200 KW AL-CH. 250 D.C. 2300/4000 A.C. 1200 RPM
150 KW G.E. 250 D.C. 2300/4000 A.C. 1200 RPM
150 KW WEST. 250 D.C. 2300/4000 A.C. 1200 RPM

MOTOR GENERATORS

350 KW G.E. SYN. 250 V. 2300/4000 A.C. 1200 RPM
300 KW G.E. SYN. 250 V. 2300/4000 A.C. 1200 RPM
200 KW G.E. SYN. 250 V. 2300/4000 A.C. 1200 RPM
200 KW G.E. IND. 600 V. 2300 A.C. 1200 RPM
200 KW R.W. SYN. 250 V. 2300/4000 A.C. 900 RPM

TURBO GENERATOR SET

300 KW GENERAL ELECTRIC-CURTIS, 250 V. D.C. Turbine. Non-Condensing, 100# Steam Pressure, 3600 RPM. Gen. ELEC. 300 KW MPC Generator and D.C. Panel.

Each unit listed above is owned by us and is Available now for immediate purchase.

WALLACE E. KIRK CO.

Incorporated

502 Grant Building Pittsburgh, Pa.

WE SELL — PURCHASE — RENT

Power & Dist. Transf. from one to 5000 KVA. Any Volt or Frequency.

Motors, Generators, Turbines, Centrifugal Pumps, etc.

A.C. & D.C. Elec'l Meters. Potential & Current Transf. All Makes. Scales Calibrated to your requirements.

Catalog & Prices on Request

PHILADELPHIA TRANSFORMER COMPANY

2829 Cedar St. Phila. Pa.

PIPE

CUT TO SKETCH ⅛" to 24"

METROPOLITAN
PLUMBING SUPPLY CO., INC.
INDUSTRIAL AND MARINE SUPPLIES
Large SURPLUS STOCKS
STEEL--WROUGHT IRON--CAST IRON
BRASS-COPPER-CEMENT LINED PIPE
Power Plant Valves & Engineering Specialties - Jenkins - Fairbanks & Sarco Valves
313 EAST 31st STREET, N.Y.C.
HOURLY NATION-WIDE SHIPMENTS
Phone MU rray Hill 3-3408

FLANGED VALVES & FITTINGS

NEED ANYTHING?

180 HP Fairbanks "VA" Diesel Engine.
360 HP 300 KVA 2300 V. Diesel Generator.
150 HP 100 KW St. Marys Diesel Generator
150 HP St. Marys Horiz. Diesel Engine.
100 HP #419 Kewanee Firebox Boiler.
275 HP Heine 165 lb. Watertube Boiler.
562 ft. Chic. Pneu. 100# Air Compressor.
48" x 3/16" x 57 ft. Steel Stack.
75, 125, 200 KVA A. C. Generators.
Clutch Pulley for 360 HP Fairbanks Diesel.
1¼ Yd. Gaso. Crawler Cranes & Shovels.

MISSISSIPPI VALLEY EQUIPMENT CO.

507 Locust St. St. Louis, Mo.
Have you anything for Sale?

1200# Pressure Air or Gas Compressor

Worthington, horizontal, three-stage, steam-driven. Formerly used for CO_2.

DENNY & CLARK
910 N. Marshfield Ave. Chicago, Ill.

SEARCHLIGHT SECTION

HIGH PRESSURE BOILERS

"New and Used

Not Abused"

4—500 H.P. 200 lb. Vogt W.T. Boilers with stokers

3—516 H.P. 200 lb. B. & W. Sterling Boilers with stokers

2—72 x 18 150 lb. H.R.T. Boilers with Dutch ovens

5 sets 2½" 200 lb. blow off Yarway valves complete. Also full open bottom mud-ring boilers, 250 to 350 lb. pressure All A.S.M.E. Code

JOE SULLIVAN CO.

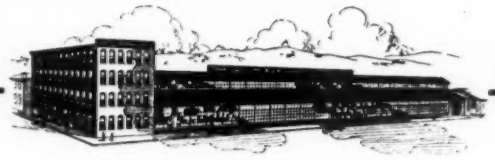
523 N. Hamlin Ave. Chicago, Ill.

Phone Van Buren 8669

FOR SALE

1—813 HP, 200# ASME W. T. Boiler
1—500 HP, 200# ASME W. T. Boiler
1—150 Ft. Coal & Ash Conveyor
2—300 HP, 160# B&W W. T. Boilers
2—750 KVA 2300 V. Turbo-Gen. Sets
1—18x18 Single Roll Coal Crusher

H. & P. MACHINERY CO. 6719 Etzel Ave., St. Louis, Mo.



AT YOUR SERVICE

120,000 SQ. FT. OF WAREHOUSE SPACE . .

. . . Housing our Complete Rebuilding Facilities . . . Also a wide range of Electric Motors and Power Plant Equipment

TODAY'S DEMAND FOR RECONDITIONED EQUIPMENT OBSOLETES OUR STOCK LISTING BEFORE IT CAN BE PRINTED

Write your requirements for

MOTORS
GENERATORS
MOTOR-GENERATOR SETS
ENGINE-GENERATOR UNITS

THE GLOW ELECTRIC CO.

933-943 HARRIET ST. Phone MA. 3024 CINCINNATI, OHIO

FOR SALE—BOILERS

2—150 HP each Stanwood down draft fire box boilers, ASME, 125# pressure, shaking grates.

1—125 HP Kewannee horizontal fire box boiler, shaking grates, with fittings and attachments, for heating purposes, 15#.

Let us know if you have any boilers for sale.

THE ACME EQUIPMENT COMPANY

14057 Schaefer Highway

Detroit, Michigan

1—7500 KW. 5000 v. 60 Cy. 3 Ph. TURBO with Surface Condenser

1—4000 KW. TURBO 4150 v. 60 Cy. 3 Ph. with Cond.

1—3000 KW. TURBO 60 Cy. 3 Ph. 480 v. with Cond.

HEAT EXCHANGER 606 tubes 1¼" x 9'6"

1500 CFM 2 STAGE AIR COMP. 275 Hp. 2200 v. 60 Cy. 3 Ph. Syn. Motor Dr.

3—100 KW. 125-250 V. DC. G.E. TURBOS

1—New FAN 66750 CFM 2" to 6" Pres.

4—CENT. PUMPS 4166 GPM. 162' Head with 440 v. 60 Cy. 3 Ph. AC. Motors

1—36000 GPM, 27' head CENT. PUMPS

400, 700, 1500, and 2500 HP. A.C. Motors

TRAVELING CRANE 75 ton Case, 64' span, 3 motors. Also others.

750 KW. and 110 KW. AC HYDRO ELEC. PLANTS and others

3—559 Hp. 200# BOILERS with stokers

ROSS POWER EQUIPMENT CO., Indianapolis, Ind.

VALVES

INDUSTRIAL & MARINE

METROPOLITAN PLUMBING SUPPLY CO., INC.

Power Plant Valves and Engineering Specialties for Oil, Steam, Gas, Air, Liquids and Chemicals.
Jenkins, Fairbanks, Sarco, Powell Valves and surplus.
Large Complete Stocks ⅛" to 24"
313 EAST 31st ST., NEW YORK CITY
For Hourly Nation-wide Shipments CALL MUrray Hill 3-3408

CRANE PIPE & FITTINGS

Reconditioned Boilers

IN STOCK

2—225 HP Johnson Comb. Water Tube firebox boilers, 160# pres.
1—585 HP Erie City 2 drum Vertical Water tube ASME 185# boiler.
Also—30 H.R.T. and portable type boilers up to 150 HP.
¾ Yard Orton Model T Caterpillar Crane, 45 ft. boom.
3—72 x 18 150 HP Freeman 150# ASME HRT boilers.
2—78 x 20' 200 HP 150# ASME N. B. Ohio Std. HRT boilers.
1—Coal Bunker, 42 ft. long, 11 ft. wide, 10½ ft. deep.
1—1600 G.P.H. Cochrane Hot Process Combination Feed Water Heater and softener.

NELSON MACHINERY COMPANY

Green Bay, Wisconsin

FIRE TUBE BOILERS

(NEW OR USED)

ONE WEEK'S DELIVERY AFTER RECEIPT OF ORDER

Sizes from 50 H.P. to 125 H.P., 50# W.P. to 350# W.P., Oil, Gas or Coal Fired, Shaker Grates or Stokers, Hartford or Oklahoma approved Certificate.

MOORE & COMPANY

1701 Nat'l Bank of Tulsa Bldg.

Tulsa, Oklahoma

TELEPHONE 2-0058

300 KW. Motor Generator Sets

400 H.P. Boiler, 200# reset

3000 KW. Turbo unit, AC. Con.

600 cu. ft. Diesel Compressors

DIESEL Plants from 7 to 1200 KW.

STEPHEN A. DOUGLASS CO.

630 Fort Washington Ave., New York, N. Y.

FOR SALE

3000 KW 3750 KVA General Electric 3 phase, 60 cycle, 480 v., 150# Condensing, 3600 RPM Steam Turbo Generator with complete Powerhouse Auxiliaries. Surface Condenser, Exciters, Evactors, Condensate Pumps, Switchboard, Regulator, 10 Distribution Panels, 60 enclosed Safety Switch Panel Circuits, 20-ton Bridge Crane, Circulating Pumps, Air Coolers, Piping, etc. Also 1050 HP Sterling type 260# Boiler.

Sundfelt Equipment Company

3422 First Ave. So., Seattle, Wash.

ROTARY DRYER

24' x 72" x 9/16" shell, gear drive

ROTARY BALL MILL

20' x 72" x 3/4" shell, gear drive

NATIONAL BOILER & EQUIPMENT SALES COMPANY

2732 No. Talbott Ave., Indianapolis, Ind.

FOR SALE

Used, #1 pipe, rebuilt, guaranteed valves, and fittings, 2" to 20"—boiler flues—condenser tubes. Boilers any HP. STEEL BUILDINGS—pumps—tanks. Gas—diesel—steam generating sets.

INDUSTRIAL SUPPLY & EQUIPMENT CO. INC.
1044 Canal Bank Bldg., New Orleans, La.

POWER EQUIPMENT FOR PROMPT SHIPMENT

SQUIRREL CAGE MOTORS (3 ph. 60 cy.)

HP	Make	Volts	Speed	Type
700	G. E.	6600	1800	
150	West.	220/440	580	CCL
125/40	Cr. Wh.	2200	700	125AQ
125	Burke	220/440	1200	
125	Cr. Wh.	2200	700	125AQ

DC SERIES & CPD. MOTORS

HP	Make	Type	Speed
2	R & M	122	1000
5	R & M	125	1000
15	West.		650
25	Shaw		600
50	Shaw		600
100	G. E.	MD 108	480
130	G. E.	CO 1812	550
175	G. E.	MDS 1904	475
200	Allis	Interpole	600

SYN. MOTORS, 3 ph. 60 cy.

HP	Make	Volts	Speed
75 (2)	G. E. ATI	2200	900

SLIP RING MOTORS, (3 ph. 60 cy.)

HP	Make	Volts	Speed	Type
1000	Al. Ch.	440	235	
700	G. E.	2200	393	MT 432
300	G. E.	440	600	I-M
200	G. E.	2200	240	MT 412
150	G. E.	220/440	720	I-M
150	Al. Ch.	2200	685	
150	G. E.	220	575	I-M
125	Al. Ch.	2200	435	
100	Al. Ch.	220/440	575	
100	G. E.-25 cy.	220/440	500	MI-108

"Wound Rotor Motors" (3 ph. 60 cy.)

HP	Make	Volts	Speed	Type
200	G. E.	2200	600	I-L
150	G. E.	2200	600	I-L

TRANSFORMERS

Qu.	KVA	Make	Voltage
3	37	West.	4400/185
3	50	G. E.	22000/2200
3	75	G. E.	2300/110/220
3	100	Uptegraff	440/220
1	150	G. E. (3 ph.)	2080/230/460

OIL ENGINE DRIVE AIR COMPRESSORS

Chicago Pneumatic simplate valve type, NS03 straight line 16½ & 11 x 18" capacity 492 cu. ft. displacement, 100# pressure, with air receiver and starting air compressor.
2—14x10" Sullivan 505 cu.ft. compressors
1—10x12 Ch. Pneu. 164 cu.ft. steam compressor

M-G SETS 3 ph. 60 cy. (Syn)

150 KW West. 550 v. DC—2200 AC 1200 RPM
150 KW Ridg. 250 v. DC—2300/3/60 AC
65 KW G.E. 250 v. 1200 RPM—100 HP 220/440 v. AC

ELECTRIC LOCOMOTIVES

4—6 Ton G. E. Storage Battery Loco. 44" Ga. with Batteries (Can change to 36" Ga.)
2—5 Ton West. 250 v. 36" Ga. with Gathering reels.

SCREENS

2—4' x 5' Tyler Hummer Screens with Vibrators.

In addition to the above, we have hundreds of other items in stock—kindly send us your inquiries.

MOORHEAD-REITMEYER CO., INC.

Pittsburgh, Pennsylvania

IF YOU DON'T KNOW MACHINERY—KNOW YOUR MACHINERY DEALER

COMPLETE POWER PLANTS

TURBO-GENERATORS—CONDENSING

1—7500 KW G. E. Co., 60-3-5000 V
2—5000 KW G. E. Co., 60-3-2300 V
1—5000 KW Westinghouse, 60-3-2300 V
1—4000 KW G. E. Co., 60-3-2300, 4000 V
1—3200 KW Allis-Chal., 60-3-2300, 4000
1—2500 KW G. E. Co., 60-3-2400, 4000
1—2500 KW G. E. Co., 60-3-2300
1—2000 KW Westinghouse, 60-3-480 V
1—2000 KW G. E. Co., 60-3-600 V
1—2000 KW G. E. Co., 60-3-2300 V
1—1500 KW Westinghouse, 60-3-2300
1—1250 KW G. E. Co., 60-3-2300
3—1000 KW G. E. Co., 60-3-2300
2— 750 KW G. E. Co., 60-3-2300
2— 520 KW G. E. Co., 60-3-2300
Also 1—200 and 1—300 KW Tubes.

TURBO-GENERATORS—NON-CONDENSING

1—2000 KW G. E. Co., 60-3-480
1—1200 KW Terry, 60-3-480
2—1000 KW G. E. Co., 60-3-480
1—1000 KW Allis Ch., 60-3-2300
1— 750 KW Westinghouse, 60-3-480
350# 100# EXHAUST
1—750 KW Westinghouse, 60-3-2300
Also some smaller units

BOILERS

1—1250 HP Keeler, 175#
1—1000 HP B & W 200#
4—1000 HP Heine 250#
4— 750 HP Edgmoor 200#
2— 500 HP Edgmoor 150#
4— 620 HP Badenhausen 160#
Smaller boilers on application.
Surface Cond. 3600 sq. ft. to 12000 sq. ft.

CHARLES B. REARICK — **30 Church St., New York**

TURBO UNITS—60 CYCLE

1—5000 KW G. E. condensing.
1—3200 KW Allis-Chalmers condensing.
1—2500 KW G. E. condensing.
1— 500 KW West. condensing.
1— 300 KW G. E. non-condensing.

TRANSFORMERS

Single Phase, 60 Cycle

3—150 KVA Pittsburgh, 6600/220-440 V.
3—100 KVA G. E. 13,200-6600/2200 V.
2— 75 KVA West. 2200/110-220 V.
2— 75 KVA West. 6600/230-460 V.
2—37½ KVA Pittsburgh 2200/220-440 V.

We have other equipment, send us your inquiries

TIPPINS MACHINERY COMPANY
3528 Forbes St. Pittsburgh, Pa.

FOR SALE

DIESEL ELECTRIC GENERATOR SET

3 Phase, 60 cycles, 220 volts, 600 R.P.M.

Consisting of: 60 K. W. BURKE Generator, directly connected to "Standard" 6 cylinder heavy duty Diesel Engine. Complete with exciter, main panel board, and automatic voltage control.

Ask for Details—*A BARGAIN FOR SOMEONE*

MOREY MACHINERY CO., INC.
410 Broome Street New York, N.Y.

Priced For Immediate Sale!

1—520 HP Hamilton Corliss Engine Generator Set, direct connected to G.E. 360 KW Generator, 3/60/480 volt, 150 RPM, with G.E. Exciter and Westinghouse 3 panel switchboard. PRICE $1500.00.
At Location, SALT LAKE CITY, UTAH

Several Boilers, from 100 to 500 HP, with and without Stokers at other locations.

BRILL Equipment Co
183 VARICK STREET NEW YORK

BOILERS

Big State Boiler & Engineering Co.

TELEPHONE : 3-4818
P. O. BOX 1974 • FORT WORTH, TEXAS

---

250 KW 125 V. 320 RPM with 4 CYL. 11 x 12 VERTICAL Uniflow engine.
NEW 400 H.P. 4 CYL. 11 x 10 VERTICAL Uniflow engine.
2—566 H.P. B. & W. 200# Code straight tube coal fired boilers.
75 KW D.C. Gasoline engine set, factory job.
75 KW 125 V. Syn. Motor Generator set, also 250 V. set same size.
80, 150 H.P. Portable Boilers.
50 KW GE Marine 3 wire set.
200 KW Skinner Uniflow engine set, 125 or 250 V. as wanted.
Turbos, M. G. sets, transformers.

Send your lists of equipment.

JAMES K. HOOPER
50 CHURCH ST. NEW YORK

Reconditioned Motors, Generators, Control Equipment, etc.
Send for 32 page stock list.
Electric Apparatus Repair Company
Specialists on Rebuilding Motors, Generators and Controls
1410 No. 6th St., PHILA., PA.

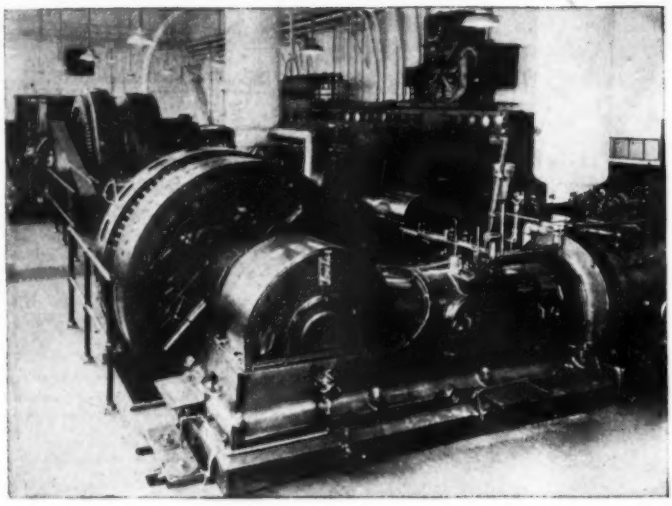
1—Stirling, W.T. 200#, 500 H.P.
2—200 H.P. HRT suspended, Type-E, stokers, coal bunker, breeching and stack.
1—54" x 12' COCHRANE (live steam) separator.
5—130 H.P. HRT boilers, complete plant.
1—625 K.W. (Bleeder) turbine.

H. P. BREARLEY
3423—91st Street Jackson Heights, N. Y.

1—Westinghouse CS, 500 HP, 450 rpm, AC motor. Needs rewinding. Will rewind to any speed and voltage within capacity of frame.
1—G. E. slip ring motor, 1-15A, 125 HP, 600 rmp, 440-3-60, rebuilt.
3—G.E. Transformers, 37½ KVA, 22000/115-230 volt, 1 ph. 60 cy
1—400 amp. DC welding M-G set, 440-3-60 supply voltage.

SEND US YOUR INQUIRIES.
JACKSON BAYLEY ELECTRIC COMPANY
CANTON, OHIO

COMPLETE POWER PLANT



IMMEDIATE DELIVERY!

Will sell subject to Government regulation and prior sale.

3 Skinner Uniflow engines with Westinghouse generators and exciters rated 1000—375—62½ kva, all 440v—60C—3ph.

Also include 2 HRT Nu-Way boilers rated 255bhp each with Whitin stokers, etc. Plant open for inspection.

P.O. Box 852, La Crosse, Wis.

FOR IMMEDIATE DELIVERY

One 260 H. P. Dillon H. R. T. BOILER

A.S.M.E. Code
Built 1934 Used 3 Years
With Westinghouse Stoker
Cash Combustion Controls
Working Pressure 150 lbs.
Condition Guaranteed
Located Central New York

LARGE STOCK
FURNACE BLOWERS
BOILER FEED PUMPS, ETC.

JOHN W. HUBBARD
670 SIXTH AVE., NEW YORK CITY
Watkins 9-0520

FOR SALE

Synchronous Motors:
650 HP. General Electric type ATI 550 volt 3 phase 60 cycle 240 rpm with control and drive.
242 HP. Fort Wayne (General Electric) 2300 volt 2 phase 60 cycle 514 rpm rails and pulley.
200 HP. General Electric type ATI 220 volt 3 phase 60 cycle 720 rpm with control.

Squirrel Cage Motors:
500 HP. General Electric form K 440 volt 3 phase 60 cycle 1200 rpm with control
225 HP. General Electric form K 2200 volt 3 phase 60 cycle 600 rpm with control
150 HP. Westinghouse type CS 440 volt 3 phase 60 cycle 900 rpm with compensator
100 HP. Westinghouse type CS 550 volt 3 phase 60 cycle 600 rpm (two in stock)
75 HP. General Electric form K 2200 volt 3 phase 60 cycle 514 rpm

Adjustable Speed 220 volt D.C. Motors:
100 HP. Westinghouse type SK 450 to 1000 rpm
80 HP. Burke 200 to 800 rpm.
35 HP. General Electric 625 to 1300 rpm.

ALSO OTHER SIZES IN STOCK

ANDREN-MYERSON CORP.
411 Atlantic Ave. Boston, Mass.
Tel: Liberty 4300

---

230 VOLT D. C. MOTORS

Quantity	HP.	Make	Type	Speed
2	20	G.E.	CVC–116	925
1	20	G.E.	RC–11	1150
2	20	G.E.	CQ–15	925
2	15	G.E.	CVC–115	925
1	15	G.E.	RC–30	850
1	15	G.E.	RC–10	1150
1	10	G.E.	CE	650
1	10	G.E.	CE	1375
4	10	G.E.	CQ–10	650
1	10	G.E.	CR–29	850
1	10	G.E.	CVC–114	1250
1	7½	G.E.	CQ	825
2	7½	G.E.	CE	815
2	5	G.E.	CE	1100

220 VOLT D.C. MOTOR

1	20	W'hse	S	650

Will exchange for A.C. Motors or sell for cash
SONOCO PRODUCTS COMPANY
Hartsville, S. C.

FOR SALE

Power plant equipment. Steam, Diesel, electrical, boilers, engines, turbines, generators new or used.

PENN MACHINERY COMPANY
Jackson, Miss.

DIESEL ENGINES FOR SALE

1 Ruston-Hornsby horizontal (310 rpm) 4 cycle, continuous duty, 34/38 BHP cap. with 23/26 KW (29/34 KVA) 3 phase, 120/208 V generator with direct connected exciter and slide base.

1 Ruston-Hornsby horizontal (320 rpm) 4 cycle, continuous duty, 28/31 BHP cap. with 18/21 KW (22/25 KVA) 3 phase, 120/208 V generator with direct connected exciter and slide base.

Above is complete with automatic voltage regulators, complete switchboard, water pump, safety devices, alarm system, automatic oil system, filters, etc. Equipment installed new in 1941; used slightly over one year.

TRANSFORMERS FOR SALE

3 Pennsylvania 25 KVA, 3 phase, 2 to 1 ratio; rebuilt within past month.

No priority Necessary.

ECONOMY GROCERY STORES CORP.
Engineering Department
100 Business Street Hyde Park, Mass.

USED WATER TOWERS and TANKS

Bought & Sold

20,000 to 250,000 gal. capacity; oil storage, pressure, steel, wooden and glass-lined tanks; boilers, sprinkler systems, pumps and piping.

EVEREADY ELECTRIC & SUPPLY CO.
Bridgeport, Conn.
E. J. McCallum, Jr., Pres.

CORLISS ENGINE

1—18"x36"—Releasing Corliss Engine WITH Rope Drive—1100 ft. 1½" manilla rope. Good condition—in operation at present—write for details: Address

M. THOMAS, *Chief Engineer,*
Majestic Manufacturing Company,
2134 Delmar Blvd. St. Louis, Missouri.

FOR SALE

Steam Engine and Intake Fan

Engine, steam operated, 50 H.P. throttle governor type, with steam separator, fly wheels and belting; also a 6 ft. intake fan and housing manufactured by the American Blower Company, both in excellent condition.

THE SAM DAVIS COMPANY
1510 Elm St., Toledo, Ohio

FOR SALE

2—150 Kilowatt Ridgeway Steam Generator Sets. 1—200 Kilowatt Thompson-Ryan Steam Generator. 1—Horizontal Danville Hoisting Engine, 6 foot drum, 125 pound steam pressure.

THE GEORGE M. JONES CO.
Glouster, Ohio

POWER PLANT EQUIPMENT

TURBO GENERATORS

5000 KW GE Cond. 2300 volts
2500 KW GE Cond. 2300 volts
2000 KW GE Cond. 600 volts
600 KW GE Cond, 600 volts
500 KW GE Extract, 600 volts
200 KW GE Cond. 2300 volts
150 KW West Non-Cond. 600 volts

TURBINES ONLY

230 HP Terry—150 lbs.
210 HP Terry—250 lbs.
175 HP GE—110 lbs.

AIR COMPRESSORS

5600 CuFt IR 35# Motor Driven
782 CuFt IR 55# Belted
600 CuFt IR 500# Steam Driven
275 CuFt IR 110# Steam Driven
146 CuFt IR 1200# Belted
136 CuFt Chic. 110# Belted

CENTRIFUGAL COMPRESSOR

10,000 CuFt—35# Turbine Driven
7,000 CuFt 21.7# Turbine Driven

BOILERS

4—1000 HP Heine—250#—Oil
1—750 HP Heine—200# Stoker
5—318 HP Manning Type—190#
2—303 HP Sterling—160#
2—255 HP H.R.T. 150# Stoker
2—235 HP H.R.T. 175# Grates
2—200 HP H.R.T. 100# Grates
2—100 HP H.R.T. 125# Grates
1—400 HP Sterling 160# Stoker

ENGINE—GENERATORS

1000 KVA Unaflow—440 volts
375 KVA Unaflow—440 volts

Also transformers, engines and cranes

Send us your inquiries

A. LEE ELLIS CO., U. S. Mchy. Bldg., Boston, Mass.

The Buyer Must Be Satisfied—Always

NEED POWER EQUIPMENT?
(Try Us!!!)

BOILERS

POWER PLANT, with 2, 300 H.P. Boilers complete with 2, 500 KW, 3/60/2300 Turbines and Generators.
2—300 H.P. Water Tube Boilers
1—453 H.P. 160# Stirling W. T. Boiler
1—47 H.P. Vert., 60" dia., ASME, 150#

COMPRESSORS

248 CFM Chi. Pneu. with 50 H.P. A.C. Motor
526 CFM Ingersoll-Rand—belt drive
780 CFM Chi. Pneu. with 125 H.P. A.C. motor
990 CFM Sullivan with 160 H.P. A.C. motor

ELECTRIC MOTORS

30 Units 15 to 75 H.P., squirrel cage, 3/60/440 A.C.
15 Units 3 H.P. to 60 H.P. 230 V D.C.

HOIST MOTORS

100 H.P. Northern G.E. Type, 220 D.C. 475 RPM, complete
20 H.P. Northern G.E. Type, 220 D.C. complete
(Write for our Electrical List)

GENERATORS

300 H.P. Buckeye Diesel Engine & Gen. 3/60/240.
500 KW G.E. Skinner Uniflow Steam Eng. Gen., 250 V. D.C.
100 KW G.E. Type ATB-2-1250-3600 Form T, 814 amps, 3/60/2200-900 RPM
5000 KW Turbo Generator, 3/60/2300 3600 RPM, 185# W.P.
POWER PLANT—Complete with two 625 KW Turbo Generators 3/60/2300, complete with 309 H.P. each Heine Water Tube Boilers, 225# steam pressure

1000 KW FREQUENCY CHANGER SET

25 to 60 cycles.
60 cycle unit, 4150 V
25 cycle unit, 9000 V
Complete with Starting Equipment.

HOISTS

Superior Iron Works single drum, 36" dia., with 80 H.P. G.E. type MTC motor
1 to 4 ton cap. single motor monorail type hoists

WANTED ! ! ! MACHINERY & EQUIPMENT OF ALL TYPES

IRON & STEEL PRODUCTS, INC.

13488 S. Brainard Ave. 38 YEARS' EXPERIENCE Chicago, Illinois

"Anything containing IRON or STEEL"

ASME BOILER

1—200 HP Horizontal Return Tubular Boiler, ASME Code, 150 lbs. working pressure, complete fittings.

McDERMOTT BROS. COMPANY
Allentown, Pennsylvania

FOR SALE BY OWNER

AIR COMPRESSOR

Steam driven, displacement 2650 cubic feet per minute, discharge pressure up to 350 lbs. Complete with aftercooler.

FS-542, Power
520 No. Michigan Ave., Chicago, Ill.

"Opportunity" Advertising:
Think
"SEARCHLIGHT"
First

FOR SALE

AIR RECEIVERS

1—5'6"x13'x½"
1—4'x14'x½"
1—5'x12'x⅜"
1—3'6"x20'6"x½"
1—3'x17'10"x7/16"

All the above were used for working pressure 150# and are in excellent condition.

GLAZER IRON & METAL CO.
520-610 Chamberlain St.,
KNOXVILLE, TENNESSEE
Phone 3-0738

Allis-Chalmers hydro-electric plant, 1000 HP, 60' head, 750 KW, 3-60-6600 volts, a.c.
Buckeye-Allis Chalmers 260 HP oil eng. gen. set, belted: a.c. 3-60-480 v., switchboard.
Milwaukee (Westinghouse-Baldwin) 8-ton gasoline locomotive, 36" gauge, being rebuilt.
Milwaukee 7-ton 30" gauge gas locomotives (3), link & pin couplers; 100% rebuilt.
4—Steam S/T 18-ton 36" ga. 10x16 locomotives.
Orton 30-ton steam locomotive crane, 80' boom.

H. Y. SMITH CO.
828 N. Broadway Milwaukee, Wis.

FOR SALE

Immediate Delivery

Engine Generator Panel Board, Etc.

ENGINE

E. P. Allis steam engine, 150 H.P., 85 RPM, 14" bore, 36" stroke, 7" dia. crank shaft with Corliss valve. Engine is complete with drive wheel 20" wide, 10 ft. in diameter, with three-ply endless leather belt 20" wide and 76' long; also with water separator for steam supply line and drive pulley, heavy line shafting, hangers, bearings, etc. Also with one new rough turned piston head and ring, two new rough turned inlet valves, and two new rough turned exhaust valves not installed. This equipment is in good running condition.

GENERATOR

Ideal Electric Co. A. C. generator, synchronous type, 1200 RPM, 220 volt, 3 phase, 60 cycle, 100 KW. This generator is complete, including integral field exciter and power distribution board equipment. The panel board is 5'6" x 6' wide, 650 amp., 250 volt, 8 circuit, arranged with four 200 amp. 250 volt, 3 pole fusible switches and four 100 amp., 250 volt, 3 pole fusible switches, all switches totally enclosed. Generator Control Board 6' x 2' carries a G. E. diactor regulator with auxiliary appliances for stabilization and compensation; one only 300 volt voltmeter; one only 400 amp. ammeter; one only 20 amp. exciter ammeter; one only watt hour meter; one only Kilowatt demand meter; one only 400 amp., three pole, fusible switch; two only current transformers, 400 amp., for meters; one only 100 H.P. totally enclosed motor starter. All power equipment is in first-class condition.

This equipment may be inspected by appointment.

The WEBER DENTAL Mfg. Co.
2206 Thirteenth St. N. E. Canton, Ohio

MACHINE PARTS
FOR SALE

2—Westinghouse Type CS, 50 hp, 1200 RPM Motors
1—Link Belt PIV Gearmotor, 10 hp, 269-105 RPM
1—G. E. Type KT337, 75 hp, 1800 RPM Motors
(All the above 220-400 volts, 3 phase, 60 cycles)
4—Condit Type E20 Circuit Breakers, 200 Amp., 2500 Volts.
12—Circuit Breakers, Same Type, 400 Amp., 2500 Volts.
(Breakers provided with overload trip and 440 volt, 60 cycle undervoltage coils)
4—Moloney 50 KVA, 60 cycles, Single Phase Transformers primary 440 Volts, secondary tapped for 75, 100, 125 and 150 Volts
4—G. E. Voltmeters, Type AD 7, Scale 0-150 Volts
4—G. E. Single Phase KW Meters Scale 0-60 KW with resistors for 440 Volt operation
4—G. E. Current Transformers, Type JWI, 25-125 Cycles, 5000 Volts, 150-5 Amps.
2—Philadelphia Gear Reducers, Type VT, 45 HP, 870 RPM, Ratio 10.25 to 1
270 ft. Flanged 14" Cast Iron Pipe, Class B, mostly 12' lengths, with assorted fittings

REFINED SYRUPS & SUGARS, INC.
Yonkers, New York

BOILERS & STOKER

2—150 HP HRT Boilers, rebuilt, 125# allowed reset
2—Pulverzone, inclined grates, motor feed size 8" x 6"

NATIONAL BOILER & EQUIPMENT SALES COMPANY
2732 No. Talbott Ave., Indianapolis, Ind.

SEARCHLIGHT SECTION

FOR SALE

4000 KW TURBO-GENERATOR

1 Westinghouse Electric & Manufacturing Co. Turbo-Generator Turbine #2581, designed for 160 lbs. pressure at the throttle valve, direct connected to a generator #1,331,510, 3 phase, 60 cycle, 5000 KVA or 4000 KW at 80% P. F., 2300 volts, 3600 RPM, complete with Barometric Condenser, driven by a Terry steam turbine type C, and circulating pump, but no exciter; possibly complete with switchboard.

CITY OF HOLYOKE
GAS & ELECTRIC DEPT.,
70 Suffolk St. Holyoke, Mass.

DIESEL ENGINES AND GENERATOR SETS

1—20 HP Fairbanks Morse	1—100 HP Fairbanks Morse	1—210 HP Superior
1—25 HP Fairbanks Morse	1—112½ HP Buckeye	1—225 HP Buckeye
1—50 HP Cummins*	2—120 HP Hercules*	1—360 HP Fairbanks Morse
1—80 HP Atlas Imperial	2—200 HP Buda*	1—440 HP Ingersoll Rand

*Fitted With Clutch and Power Take-Off

A. G. SCHOONMAKER COMPANY
50 Church Street (Dept. Eng.) Phone—Worth 2-0455-6-7 New York, N. Y.

WANTED

2 MOTOR GENERATOR SETS

WESTINGHOUSE

37 H.P. Motor 220/440-3-60
Generator 25KW V118 A212

38.5 H.P. 220-3-60
Generator 30KW 125V A250

Complete with switches, starting compensators, regulators, instruments. Can be seen in operation. Also Westinghouse & Cut. Ham. charging units, cables, plugs, wiring.

HOLLAND LAUNDRY
1493 Hudson Blvd., Jersey City, N. J.

WANTED
PUMPS and TRANSFORMERS

1—1500 G.P.M. Underwriter Sprinkler Pump, Motor Driven, 3 ph.—60 cy.—220 V. or 208 V. with Controller

1—1500 G.P.M. Underwriter Pump, Turbine Driven, 125# Guage Dry, Throttle Steam and Zero Lbs. Back Pressure

1—150 G.P.M., 2½" x 2" Double Suction. Single Stage, Centrifugal Pump. 100# total Dynamic Head with 15 H.P. 3 ph., 60 cy., 220 V. Motor and Control

3—333 K.V.A. G.E. or West. Oil Cooled Transformers, 2400/125 V. or 4150/208 V.

DAVIDSON INDUSTRIAL CONTRACTING CO.
343 Classon Ave. Main 1-2400 Brooklyn, N. Y.

FOR SALE

One 100 K. W. 250 volt D. C. **Turbo Generator Turbine-Curtis** Form C, 2 stage 3600 R.P.M. 150# S.W.P.
Generator—100 K.W. General Electric Type MFC, Class 4-100-3600 Form T, 400 Amps. 250 volts D. C.

PILOT MARINE CORP.
25 Beaver Street New York, New York

One—40KW, 125 volt, DC motor generator set. 60HP 220 volt, AC motor with starter.

Southwestern Public Service Co.
JACKSONVILLE TEXAS

-TRANSFORMERS-

TRANSFORMERS WANTED

in operating condition or burnt out. Mail us list giving complete nameplate data and stating condition.

We Rewind, Repair and Redesign all Makes and Sizes
ALL TRANSFORMERS GUARANTEED FOR ONE YEAR
We will be pleased to quote prices on request.

THE ELECTRIC SERVICE CO., INC.
"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
STATION M Since 1912 CINCINNATI, OHIO

3-40 K W
DIESEL ELECTRIC UNITS

Complete with all meters and switchboard to be sold as one unit. 3 Wire 120-208 Volts 60 cycle.

For details write

J.R.F.—ROOM 1701
505 Fifth Avenue New York

D-C GENERATOR

1—Westinghouse 30 K.W.—115 volt—240 Amp. 300 RPF D.C. Generator. Direct connection to 9 x 10 Chuse Steam Engine with Instrument Board.
Write for details—

M. THOMAS, *Chief Engineer,*
Majestic Manufacturing Company,
2134 Delmar Blvd. St. Louis, Missouri

Put your
IDLE ENGINES
to work in the war!

• If you have large steam, Diesel or gas engines and equipment now standing idle, Beeson Bros. Engineering Co. can put them to work in the war!

Our war contracts for re-building, re-engineering and installing large power machinery continue to call for steam, Diesel and gas units in a wide range of sizes and types. We are prepared to buy and take immediate delivery on equipment meeting our current requirements, regardless of its location in the United States.

Here is your opportunity to move equipment for which you have no further use . . . to increase your plant space or make room for other equipment . . . and to make a real contribution to the war program.

Send us a description of your idle power machinery for our prompt consideration and action—today!

BEESON BROS.
ENGINEERING CO.
1410 North Spring Street, Los Angeles, Calif.

BOILER WANTED

125 or 150 H.P. 125 w.p. firebox type. Boiler must be in good condition and guaranteed inspection. Write to

FARMERS RENDERING WORKS
Iowa City, Iowa

FOR SALE
COAL PULVERIZER

For immediate service, 2000# capacity, complete with driving motor and 25 ton overhead bunker with elevator and magnetic separator.

E. G. BURNLEY
2044 N. W. 22nd Oklahoma City, Okla.

WANTED TO BUY

2—1500 H.P., 350# pressure B & W cross drum straight tube A.S.M.E. boilers, complete with grates, hopper, pulverizing equipment, not over 15 years old.

PLANT AND EQUIPMENT PURCHASING CO.
1300 Fountain Square Bldg., Cincinnati, O.
Phone Main 2142

FOR SALE

Complete Diesel Electric Power Plant 200 K.V.A. including panelboard, voltage regulator and transformers. Location South Carolina.

Immediate Delivery
Full description and price on request.

FS-549, Power
330 West 42nd Street, New York City

WANTED
Hot water heater and storage tank

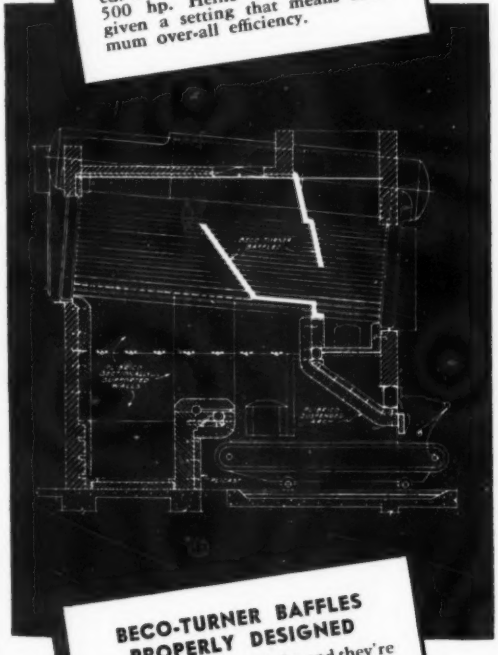
4000 gal. capacity storage and 4000 gal. heating capacity from 40° to 180° per hour. Steam pressure 15 lbs. Water pressure 20 lbs.

MERRIMAC MILLS
Methuen, Mass.

"MAKE IT OVER
MAKE IT MODERN
DO IT NOW"

A PLIBRICO JOB ALL THE WAY THROUGH

• Plibrico-designed and engineered. Plibrico walls and arches. This 500 hp. Heine boiler has been given a setting that means maximum over-all efficiency.



BECO-TURNER BAFFLES PROPERLY DESIGNED

• They're designed right and they're built right. Beco-Turner baffles are distinguished by their expansion joints which keep them gas tight.

A big order that—but we filled it here and in hundreds of plants

THE problem here was the same as in hundreds of hard-pressed plants—that of getting greater capacity and efficiency out of existing boiler equipment. It's a real order. Filling it involves, first of all, full experience with all types of boilers and fuel-burning equipment.

But the job only starts with this. The design must be put into practice with refractory walls and arches that will stand today's tough sledding. On top of this, the job must move along: Materials must be immediately available. There can be no hitches—no delays for special tile or other parts.

Here* is proof that we can fill such orders. The job was designed and engineered by the Plibrico organization. Throughout you see evidence of advanced design. For example, placing the stoker under the low end of the boiler, along with proper arch and baffle design, assures highest efficiency.

Plibrico refractories are used throughout. Plibrico Jointless Firebrick forms the entire furnace lining including both suspended arches. Plicast castable refractory material is used for the balance of the lining. The Beco-Turner baffles are positively gas tight. It's a monolithic Plibrico setting all the way.

Whether you need a complete setting like this, alterations from oil to coal, or simply require refractory repairs, we can fill *your* order—NOW. Plibrico refractories and installation service are immediately available in 100 cities in the U. S. and Canada. Ask for 48-page catalog. Specify whether you have water tube or H.R.T. boilers.

*Name on request.

PLIBRICO JOINTLESS FIREBRICK CO.
1818 Kingsbury Street (Dept. F.) CHICAGO, ILLINOIS

PLIBRICO

ADVERTISERS' INDEX

Where an * appears after a name the advertisement does not appear in this issue, but appeared in preceding issues.

Aircraft & Diesel Equipment Corp.....170
Airetool Mfg. Co.....*
Air-Maze Corp.....210
Air Preheater Corp.....*
Air Reduction.....257
Air Transport Ass'n of America for Railway Express Agency.....211
Ajax Flexible Coupling Co.....298
Alco Products Division.....225, 238
Aldrich Pump Co.....235
Alexander Hamilton Institute, Inc.....218
Allen-Sherman-Hoff Co. ....Second Cover, 162
Allis-Chalmers Mfg. Co.....15, 33, 39
Alloy Steel Products Co.....277
Allpax Co., Inc.....196
American Blower Corp.....50–51
American Brass Co.....125, 141
American Chain & Cable Co.....165
American Chimney Co.....325
American Coal Burner Co.....200
American District Steam Co.....317
American Engineering Co.....24–25
American Locomotive Co.....225, 238
American Metal Hose Branch.....125
American Pulley Co.....*
American Pulverizer Co.....*
American Radiator & Standard Sanitary Corp.....50–51
Anchor Packing Co.....267
Anderson Co., V. D.....209
Armor-Clad Co.....325
Armstrong Machine Works.....36–37
Askania Regulator Co.....*
Associated Piping & Engineering Co.....142
Atlas Valve Co.....322

Babbitt Industrial Specialties Co.....188
Babbitt Steam Specialty Co.....162
Babcock & Wilcox Co.....4–5
Babcock & Wilcox Tube Co.....290
Bacharach Industrial Instrument Co.....310
Badger & Sons, E. B.....*
Bailey Meter Co.....10–11
Baldwin De La Vergne Sales Corp.....*
Baldwin-Hill Co.....207
Baldwin Locomotive Works.....*
Bartlett & Snow Co., C. O.....251
Bates Co., Walter.....192
Beaumont Birch Co.....168
Belmont Packing & Rubber Co.....*
Bendix Aviation Corp.....294
Betz, W. H. & L. D.....*
Biddle Co., James G.....198
Bigelow-Liptak Corp., Division A. P. Green Fire Brick Co.....301
Bird-Archer Co.....*
Blaw-Knox Co.....131
Boiler Tube Co. of America.....306
Bonney Forge & Tool Works.....140
Borg Warner Corp.....213
Botfield Refractories Co.....218
Brickseal Refractory Co.....172
Bridgeport Brass Co.....319
Briggs Clarifier Co.....285
Brooks Equipment Corp.....268
Brownell Co.....320
Brown Instrument Co.....252–253, 269
Brunt Equipment Co.....325
Buell Engineering Co., Inc.....*
Buffalo Forge Co.....315
Buffalo Pumps, Inc.....*
Burgess Battery Co.....*
Burke Electric Co.....282
Byers Co., A. M.....62

Canton Stoker Corp.....270–271
Carborundum Co.....*
Cardox Corp.....*
Carey Mfg. Co., Philip.....Back Cover
Carrier Corp.....*
Cash Co., A. W.....255
Chapman Valve Mfg. Co.....205
Chicago Metal Hose Corp.....*
Chicago Pneumatic Tool Co.....278
Cities Service Oil Co.....201
Clarage Fan Co.....242
Clark Bros. Co.....*
Cleaver-Brooks Co.....179
Climax Engineering Co.....284
Clipper Mfg. Co.....*
Cochrane Corp.....181, 204
Coe Mfg. Co.....314
Coffin Jr. Co., J. S.....160
Combustion Engineering Co.....44–45
Condenser Service & Engineering Co.....281
Cooper-Bessemer Corp.....236
Coppus Engineering Corp.....147
Corning Glass Works.....196
Crane Company.....127
Crane Packing Co.....*
Crocker-Wheeler Electric Mfg. Co.....233
Cryer Trap & Valve Co.....218
Cutler-Hammer, Inc.....115

Dampney Co. of America.....283
Darling Valve & Mfg. Co.....286
Dart Mfg. Co., E. M.....178
Davis Regulator Co.....*
Dearborn Chemical Co.....229
De Bothezat Ventilating Equipment Div. American Machine & Metals, Inc.....*
DeLaval Separator Co.....226
DeLaval Steam Turbine Co.....58, 176
Deming Company.....246
Detrick Co., M. H.....*
Detroit Stoker Co.....*
Diamond Power Specialty Corp.....8–9
Dixon Crucible Co., Joseph.....194
Dowell, Inc.....*
Downingtown Iron Works.....180
Dravo Corporation.....*
Dugas Engineering Corp.....158

Eagle-Picher Lead Co.....48
Economy Pumps, Inc.....310
Edge Moor Iron Works.....296
Edward Valve & Mfg. Co., Inc.....123
Ehret Magnesia Mfg. Co.....*
Elastic Stop Nut Corp. of America.....197
Electric Controller & Mfg. Co.....240
Electric Storage Battery Co.....295
Electro Metallurgical Co.....35
Electroweld Steel Corp.....217
Elliott Company.....6–7
Engineer Co.....218
Eureka Packing Co.....164
Everlasting Valve Co.....*

Fairbanks Co.....260
Fairbanks, Morse & Co.....259
Fairfield Engineering Co., The.....206
Fawick Airflex Co., Inc.....234
Fedders Mfg. Co., Inc.....*
Federal Refractories Corp.....237
Fischer & Porter Co.....298
Fisher Governor Co.....263
Flexrock Co.....176
Fluor Corp. Ltd., The.....*
Flynn & Emrich Co.....*
Foote Bros. Gear & Machine Corp.....155
Foster Engineering Co.....*
Foster Wheeler Corp.....32
Foxboro Co.....232
France Packing Co.....*
Frederick Iron & Steel Co.....204
Frick Company.....186
Fuller Company.....156

Gardner-Denver Co.....203
Garlock Packing Co.....157
General Coal Co.....*
General Electric Co.....14, 16–17, 38
General Motors Diesel Engine Div.....175
Gifford-Wood Co.....*
Gilmer Co., L. H.....*
Globe Steel Tubes Co.....163
Goetze Gasket & Packing Co., Inc.....*
Golden-Anderson Valve Specialty Co.....262
Goodyear Tire & Rubber Co.....*
Goulds Pumps.....306
Graver Tank & Mfg. Co.....*
Greene, Tweed & Co.....176
Grinnell Co.....Third Cover
Grove Regulator Co.....275
Gulf Oil Corp.....321
Gulf Refining Co.....321

Hagan Corporation.....*
Hall Laboratories.....22–23
Haynes Stellite Co.....*
Hays Corporation.....173
Hays Institute of Combustion.....*
Hendy Iron Works, Joshua.....191
Henszey Co.....202
Hercules Float Works.....184
Hoffman Specialty Co.....*
Homestead Valve Mfg. Co.....224
Honan-Crane Corp.....154
Illinois Water Treatment Co.....242

Imperial Brass Mfg. Co.....*
Infilco Inc.....230
Ingersoll Rand Co.....274
International Nickel Co.....47, 276
Iron Fireman Mfg. Co.....159

Jenkins Bros.....132–133
Johns Manville.....129
Johnson Service Co.....*
Johnston & Jennings Co.....219
Jones & Laughlin Steel Corp.....46
Jones Foundry & Machine Co., W. A.....*

Keasbey & Mattison Co.....228
Kellogg Co., M. W.....223
Kennedy Valve Mfg. Co.....292
Kewanee Boiler Corp.....180
Kieley & Mueller.....318
Koppers Co.....195

Laclede-Christy Clay Products Co.....208
Ladish Drop Forge Co.....221
Laminated Shim Co.....*
Leavitt Machine Co.....171
Leeds & Northrup Co.....*
Lincoln Electric Co.....*
Linde Air Products Co., The.....*
Link-Belt Co.....3
Lonergan Co., J. E.....204
Lubriplate Division Fiske Bros. Refinery Co.....*
Ludlow Valve Mfg. Co.....172
Lummus Company.....291
Lunkenheimer Co.....26–27

Macmillan Petroleum Corp.....*
Magnaflux Corporation.....56–57
Magnolia Metal Co.....148
Manhattan Rubber Mfg. Division Raybestos-Manhattan.....136
Manzel Bros. Co.....314
Mark & Co., Clayton.....216
Marley Company.....*
Marsh Corp., Jas. P.....309
Martindale Electric Co.....300
Mason-Neilan Regulator Co.....220
Maxim Silencer Co.....*
McGraw-Hill Book Co.....312, 317, 322, 324

Midwest Piping & Supply Co.....199
Minneapolis-Honeywell Regulator Co. 252–253, 269
Monsanto Chemical Co.....138
Morse Chain Co.....213
Multiple V-Belt Drive Assn.....161
Murray Iron Works Co.....150

National Airoil Burner Co., Inc.....308
National Aluminate Corp.....121
National Supply Corp.....153
National Tube Co.....261
National Valve & Mfg. Co.....299
Niagara Blower Co.....*
Nicholson & Co., W. H.....186
Nordberg Mfg. Co.....*
Northern Equipment Co.....135
Norton Company .....*
Nugent & Co., W. W.....216

Oakite Products, Inc.....160
Ohio Injector Co.....*
Ozalid Products Division.....*
Pacific Pump Works.....248
Peabody Engineering Corp.....*
Permutit Company 294, 311
Philadelphia Gear Works.....*
Pipe Fabrication Institute.....227
Pittsburgh Piping & Equipment Co.....293
Plant Rubber & Asbestos Co.....280
Plibrico Jointless Fire Brick Co.....349
Pomona Pump Co.....*
Porter & Co., H. W.....*
Powell Co., Wm.....302–303
Powers Regulator Co.....325
Prat-Daniel Corp. 313
Precision Development Co.....*
Preferred Utilities Co.....212
Pritchard & Co., J. F.....*
Professional Services 320
Proportioneers, Inc. 185

Quaker Rubber Corp.....*
Quigley Co. .....*

Raybestos-Manhattan 136
Reading, Pratt & Cady Division.....165
Reeves Pulley Co.....193
Reliance Electric & Engineering Co.....49
Reliance Gauge Column Co.....30–31
Republic Flow Meters Co.....20–21
Republic Steel Corp.....18–19
Research Corp. 177
Revere Copper & Brass Inc.....169
Rhoads & Sons, J. E.....312
Richardson Scale Co.....190
Ric-Wil Company .....*
Riley Stoker Corp.....96, 97
Robbins & Myers, Inc.....289
Robins Conveyors, Inc.....297
Rockbestos Products Corp.....167
Rockwell Co., W. S.....184
Roebling's Sons Co., John A.....137
Rogers Diesel & Aircraft Corp.....*
Roper Corp., Geo. D.....*
Ross Heater & Mfg. Co.....244
Roto Company 164
Ruberoid Co., The.....183
R-S Products Corp.....146

Sarco Co., Inc.....322
Sauerman Bros., Inc.....168
Schaub Engineering Co., Fred H.....324
Scovill Mfg. Co.....28–29
Shaw Co., Benjamin F.....34
Shell Oil Co.....187
Simplex Valve & Meter Co.....256
Sinclair Refining Co.....288
Sivyer Steel Casting Co.....243
SKF Industries, Inc.....*
Skinner Engine Co.....287
Sloan Valve Co.....*
Smith Refactories Inc., Stanford C.....325
Smooth-On Mfg. Co.....207
Socony-Vacuum Oil Co.....189
Springfield Boiler Co.....52–53
Square D Co.....239
Squires Co., C. E.....308
Standard Oil Co. of California.....250
Standard Oil Co. of Indiana.....151–152
Standard Pressed Steel Co.....180
Star Test Pocket Pliers.....325
Steel & Tubes Division.....18–19
Stephens-Adamson Mfg. Co.....145
Stickle Steam Specialties Co.....166
Stock Engineering Co.....318
Strong, Carlisle & Hammond Co.....310
Sturtevant Co., B. F.....40–41
Sturtevant Mill Co.....144
Sullivan Machinery Co.....*
Sun Oil Co.....119
Superior Diesel Engine Div.....153
Swartwout Co. 352
Syntron Company .....*

Tal's Prestal Bender, Inc.....300
Taylor & Co., W. A.....211
Taylor Forge & Pipe Works.....266
Taylor Instrument Companies.....323
Terry Steam Turbine Co., The.....54–55
Texas Company 12–13
Thermoid Rubber Div.....231
Tide Water Associated Oil Co.....272–273
Timken Roller Bearing Co.....265
Todd Combustion Equipment Co.....247
Toledo Pipe Threading Machine Co.....314
Trill Indicator Co.....*
Tripp Metallic Packing Co.....325
Troy Engine & Machine Co.....304–305
Tube-Turns, Inc. 139

Union Asbestos & Rubber Co.....254
Union Carbide & Carbon Corp.....35
Universal Zonolite Insulation Co.....279
U. S. Machine Corp.....241
U. S. Rubber Co.....*
U. S. Steel Corp. Subsidiaries.....261

Viking Pump Co.....162
Vogt Machine Co., Henry 222
Voss Co., J. H. H.....*

Walworth Co. 249
Warren Steam Pump Co.....182
Water Treatment Co. of America.....*
Watson-Stillman Co. .....*
Webster & Co., Warren.....214
Westinghouse Electric & Mfg. Co.....60–61
Weston Electrical Instrument Co.....*
Wheelco Instruments Co.....174
Where to Buy.....325
Whitlock Mfg. Co.....300
Wickwire Spencer Steel Co.....258
Wilkening Mfg. Co.....307
Wilson Inc., Thomas C.....149
Wing Mfg. Co., L. J.....245
Wolverine Tube Division.....*
Wood's Sons Co., T. B.....*
Woodward Governor Co.....264
Worthington Pump & Machinery Corp.....215
Wright Mfg. Division.....*

X-Pando Corp. .....*
Xzit Sales Co.....*

Yarnall-Waring Co. 42–43, 117, 184, 192
Youngstown Sheet & Tube Co.....143

PROFESSIONAL SERVICES 320

SEARCHLIGHT SECTION

(Classified Advertising)

Classification	Page
Classification	Page
BUSINESS OPPORTUNITIES	326
EMPLOYMENT SERVICES	326
MOTOR REWINDING	326
Hunt, C. V.	326
POSITIONS VACANT	326
POSITIONS WANTED	326
SELLING OPPORTUNITIES	326
SPECIAL SERVICES	—
Rogers & Co., Ralph H	326
WANTED TO PURCHASE	348
USED AND SURPLUS EQUIPMENT	326-348
Acme Equipment Co	344
Andrew-Myerson Corp.	346
Beeson Bros. Engr. Co	348
Belyea Co., Inc	333
Berger Bros. Elect. Mts. Inc	328
Big State Boiler & Engr. Co	345
Birch Manufacturing Co	342
Brearley, H. P	345
Brew, Woltman & Co., Inc	338
Brill Equipment Corp	345
Burnley, E. G	348
Chicago Construction Equip. Co	342
Chicago Electric Co	332
Crawbuck Co., John D	342
Davidson Industrial Contracting Co	348
Davis Co., Sam	346
Davis, J. F	342
Denny & Clark	343
Douglass Co., Stephen A	344
Duquesne Electric & Mfg. Co	335
Economy Grocery Stores Corp	346
Electric Apparatus Repair Co	345
Electric Equipment Co.	334
Electric Motor & Repair Co	342
Electric Service Co., Inc	348
Ellis Co., A. Lee	347
Emsco Equip. Co	340
Erie Electric Co., Inc	341
Eveready Electric & Supply Co	346
Farmers Rendering Works	348
F. J. R	348
Fletcher Sales Co	340
Glazer Iron & Metal Co	347
Glow Electric Co	344
H & P Machinery Co	344
Hall & Co., Inc., Stephen	342
Heat & Power Co	337
Hemphill & Co., Inc., J. L	327
Holland Laundry	348
Holyoke, City of	348
Hooper, James K	345
Hubbard, John W	346
Industrial Supply & Equipment Co., Inc	344
Iron & Steel Products, Inc	347
Jackson-Bayley Electric Co	345
Jones Co., George M	346
Keystone Power Plant Eq. Co	340
Kiemle Co., F. W	328
Kirk Co., Wallace C	343
Land & Co., L. J	336
MacCabe Co., T. B	339
Majestic Mfg. Co	346, 348
McDermott Bros. Co	347
Merrimac Mills Co	348
Metropolitan Plumbing Supply Co., Inc	343, 344
Mississippi Valley Equipment Co	343
Moore & Co	344
Moorhead-Reitmeyer Co., Inc	345
Morey Machy. Co. Inc	345
National Boiler & Eq. Sales Co	344, 347
National Power Machinery Co	329
Nelson Machy. Co	344
O'Brien Machy. Co	330
Penn Mchy. Co	346
Phila Transformer Co	343
Pilot Marine Corp	348
Plant & Equip. Purchasing Co	348
Power Plant Equipment Co., Inc	338
Rearick, Charles B	345
Refined Syrups & Sugars Inc	347
Ross Power Eq. Co	344
Ruderman Machy. Exch	344
Schoonmaker Co., A. G	348
Smith Co., H. Y	347
Sonoco Products Co	346
Southwestern Public Service Co	348
Stewart & Co., Inc., Paul	331, 341
Sullivan Co., Joe	344
Sullivan, W. L	326, 340
Sunafelt Equipment Co	344
Tippins Machinery Co	345
Wente Electric Co	343
Weber Dental Mfg. Co	347
Wilms, Weaver & Co	339

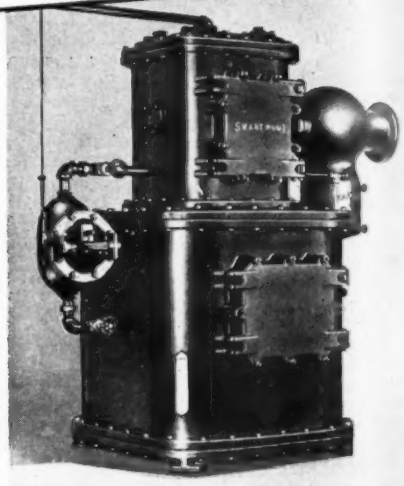
All different— the better to serve your particular situation . . .

All alike in principle— to assure you the utmost in heating capacity and oxygen removal

Feed Water Heaters

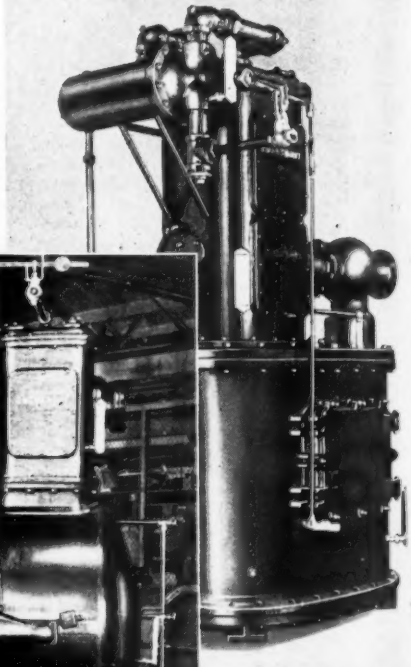
that bear the name

★ Swartwout ★

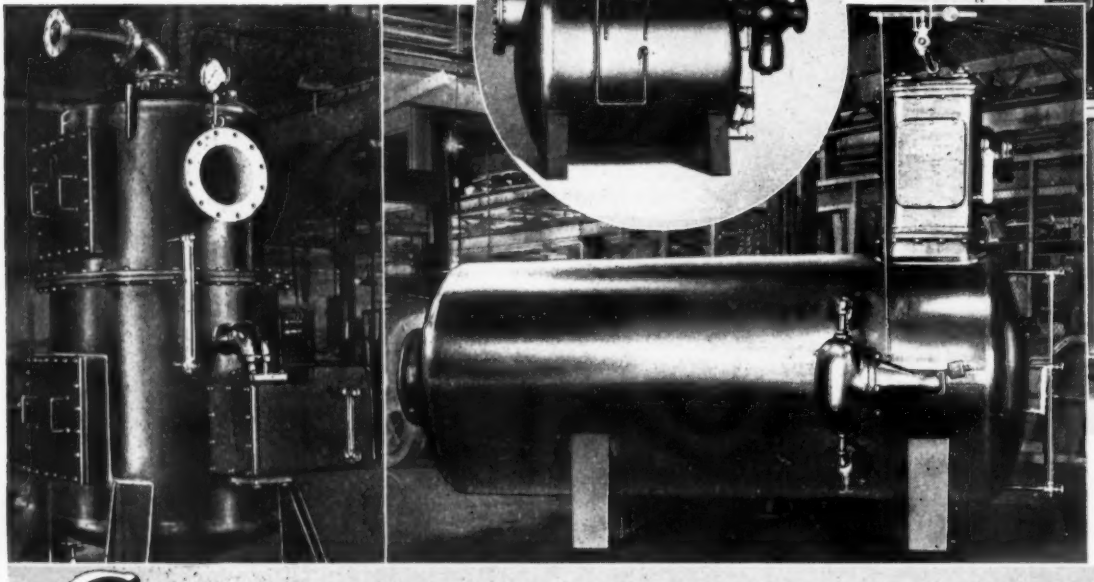


EACH HEATER pictured here was engineered to meet somebody's need; it might be *yours,* with a little more or less heating capacity or storage space, or tailored to meet space limitations. The method of heating and deaerating in all of them is Swartwout's, guaranteed to produce the results required. The proved ability of Swartwout Heaters to remove oxygen and mineral solids from feed water means less outage—lower maintenance and expense. Their rugged construction . . . backed by Swartwout's high standards of engineering, workmanship and materials . . . means life-time trouble-free performance.

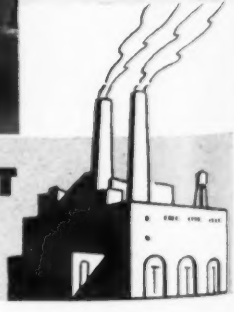
Write for Bulletin S-18-D.



The Swartwout Company
18501 Euclid Ave. Cleveland, Ohio



Swartwout POWER PLANT EQUIPMENT



FLUID TRANSPORT

The Nation's 5th Carrier...

PIPE FITTINGS

WASHING 50,000 FACES is a major job of FLUID TRANSPORT. Imagine the number and variety of pipe fittings needed to install water, heat and sewerage systems in an army camp large enough to house and train many thousands of recruits.

Pipe systems like that define the true function of Grinnell FLUID TRANSPORT. Included are every type of pipe fittings, from the tiny fitting for ¼" tubing to the extra heavy welding fitting for a 24" steam power line.

For new war construction, or maintenance and repair of existing piping, call Grinnell Company, Inc., Executive Offices, Providence, Rhode Island. Plants and offices throughout the United States and Canada.

GRINNELL

WHENEVER **PIPING** IS INVOLVED

Cast and Malleable Iron Pipe Fittings

Welding Fittings

Malleable Unions

Steel and Malleable Iron Tube Fittings

VICTORY IS MOVING OVER AMERICA'S

POWER LINES!

● Today, every kilowatt counts as never before. Total war calls for total POWER . . . a fact well recognized by American's power industry, which is performing a notable war service by stepping up production to an all-time high.

CAREY Heat Insulations—perfected through years of research and experience—are providing efficient insulation service in many of the nation's largest public utilities, as well as in industrial power plants of every size. By reducing fuel consumption to a minimum, these durable Magnesia and Asbestos Insulations are making possible the utmost in kilowatt production at lowest operating cost.

Whatever your needs, you can be sure of getting dependable service with CAREY Heat Insulations. Our nation-wide distribution and engineering organization is available at all times. Catalog mailed on request—address Dept. 16.

Carey

HEAT INSULATIONS . . .

85% Magnesia
For High and Medium Pressure.

Combination Hi-Temp—85% Magnesia.

Hi-Temp Blocks
For Furnaces, Ovens, Kilns, etc.

Careycel Insulation
For temperatures up to 300°F.

THE PHILIP CAREY MANUFACTURING COMPANY
Lockland, Cincinnati, Ohio
IN CANADA: THE PHILIP CAREY COMPANY, LTD. Office and Factory: LENNOXVILLE, P. Q.

Dependable Products Since 1873